the OIL AND GAS JOURNAL

JUNE 20, 1955

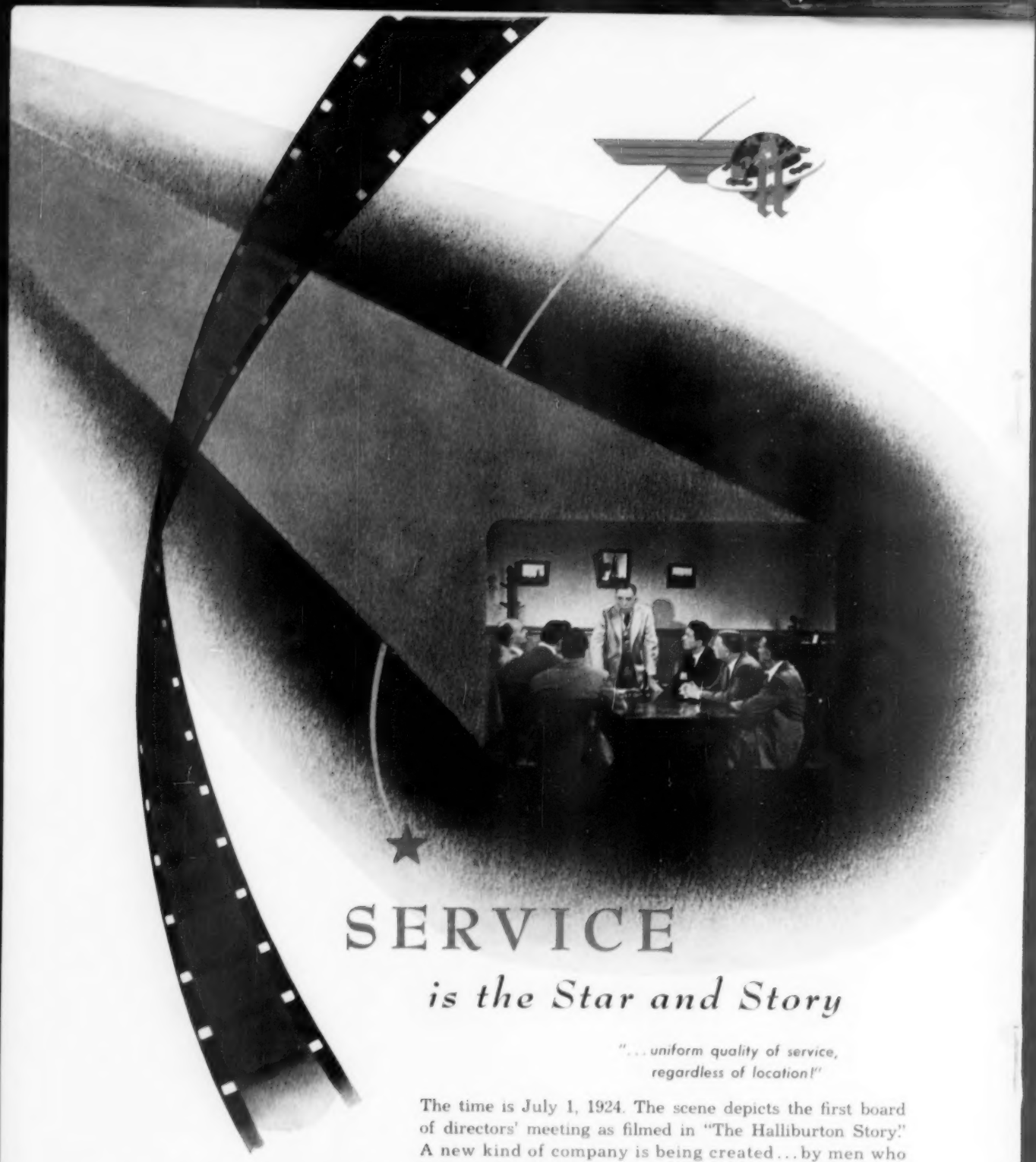
ASPHALT HEADED FOR NEW RECORDS—

and 1955 is only the beginning . . . page 58

UPGRADING HYDROCARBONS BY OXIDATION

. . . New Petrochemical Series Starting on Page 82

Also . . . Geophysics Can Find More Oil for You • Page 95



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The time is July 1, 1924. The scene depicts the first board of directors' meeting as filmed in "The Halliburton Story." A new kind of company is being created... by men who believe that business is more than a device for making money, that greater satisfaction comes from performing a service to the industry, service beyond the fee, service above all. Is it surprising that such a policy attracted more and more customers? Halliburton today is a world-wide service organization and the leader in its field. Service is still the star and story of Halliburton... and research is our most important service.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

PROGRESS IN SERVICE THROUGH RESEARCH

PAGE 1 ONE . . . a glance ahead

Drilling contractors will probably come up with new ways of trimming costs as slim-hole drilling becomes more acceptable. Many of the early objections to slim-hole drilling are being eliminated. Equipment is now available that permits logging of these undersized holes. Most service companies also have designed equipment to handle the usual drilling and completion work, such as cementing, testing, squeezing, and perforating.

Discoveries in some unexpected spots should pop up during the remainder of 1955. Most of the potential exploration hot spots are in the Rockies, but oil hunters also are eying such areas as Lake St. Clair in Ontario, the Dalhart basin in the northwestern corner of the Texas Panhandle, the Arbuckle area of southern Oklahoma, far southwestern Texas' Val Verde basin, the Alberta foothills, and California's central San Joaquin Valley.

Canada's political bigwigs are expected to approve the deal cooking between Trans-Canada Pipe Lines, Ltd., and Tennessee Gas Transmission Co. The deal involves an exchange of gas between the two firms. The proposal will temporarily shelve the all-Canadian line proposed by Trans-Canada, but will get the same amount of gas to Canada's eastern markets, which is the aim of the all-Canadian line. The all-Canadian line will remain in the plans, but will not be built for several years.

Refiners are losing some interest in making petroleum aromatics for the chemical trade. Both benzene and toluene are in ample supply. Two companies have cut benzene prices 4 cents a gallon since the first of the year, and more reductions may be in order as some long-term contracts expire. Xylene still enjoys a relatively good, but limited, chemical market. Besides, refiners are finding they need their aromatics to remain competitive in the octane race.

Several oil soluble inhibitors for use in jet fuels soon will be approved by the Air Materiel Command. Currently only one inhibitor, a quartenary-ammonia compound, has the Air Force's blessing for use in JP-4 jet fuel.

Isomerization looks like the solution to one of the refiner's biggest problems—what to do with pentanes. Conversion of poor-quality normal pentane to high-octane isopentane appears economically promising, using a platinum-type catalyst on a narrow C_5 feed stock. Commercial application of this isomerization process is now being seriously considered.

the OIL AND GAS JOURNAL

JUNE 20, 1955 • VOLUME 54 • NUMBER 7

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TECHNOLOGY—OPERATION

L.P.G. to Chemicals . . . By Oxidation 82

By Dr. Ronald G. Meyer

This first in a series of articles on oxygenated chemicals points out the advantages of the oxidation route for upgrading hydrocarbons: (1) low cost, (2) flexibility, and (3) high purity.

Good Engineering Pays Off in Slick-Wilcox Field 87

By W. H. Rosser

Corrosion and salt-water-production problems are licked by chemical inhibitors and individual well recompletions in this Southwest Texas field.

Octane Numbers in Less Time 89

By Hudson W. Kellogg

The compression-ratio procedure for determining octane numbers is fast (time saving—65 per cent) and accurate with no change in A.S.T.M. equipment.

Handling of Lease Liquid By Stage Separation 91

By John M. Campbell

This provides one or more outlets for evolved gas under carefully controlled conditions. Its purpose is to increase stock-tank recovery and to prevent the bulk of the vapors from entering the stock tank.

The 10 Per Cent Point Slope 93

By Oscar C. Bridgeman

The 10 per cent slope is being used more and more as a characterization variable in fuel-vaporization processes. Here's an evaluation of its use.

Geophysics Can Find More Oil For You 95

By Norman S. Morrisey

Since 1944, one out of every six new-field wildcats staked on basis of seismic data was successful. Industry average for all such tests was only one in nine.

Here's How Uniflux Trays Are Performing 100

Over 100 fractionating towers now using these trays have efficiencies at least equivalent to those obtained with well-designed bubble-cap trays.

Air Coring—New Boon to Water Flooding 105

By Norman S. Morrisey

Results of an experimental test show that coring with air may permit oil companies to evaluate water-flood leases more accurately.

Here's How Transco Internally Coats 36-in. Pipe 111

By F. Lawrence Resen

About 200 miles of 36-in. pipe and 80 miles of 30-in. pipe are being sprayed internally with an epoxy-based resin.

Pipeline Patrol: Coating Practices and Protection Costs 133

By Dean C. Glass

A.P.I. survey reveals 95 per cent of crude and product pipelines are being coated; industry prefers coal-tar coating; and protection costs on bare lines are 10 times as much as those on coated lines.

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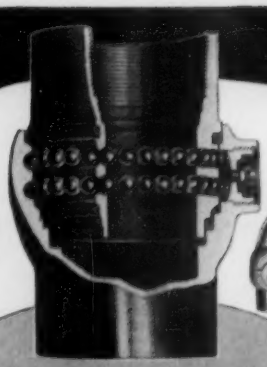

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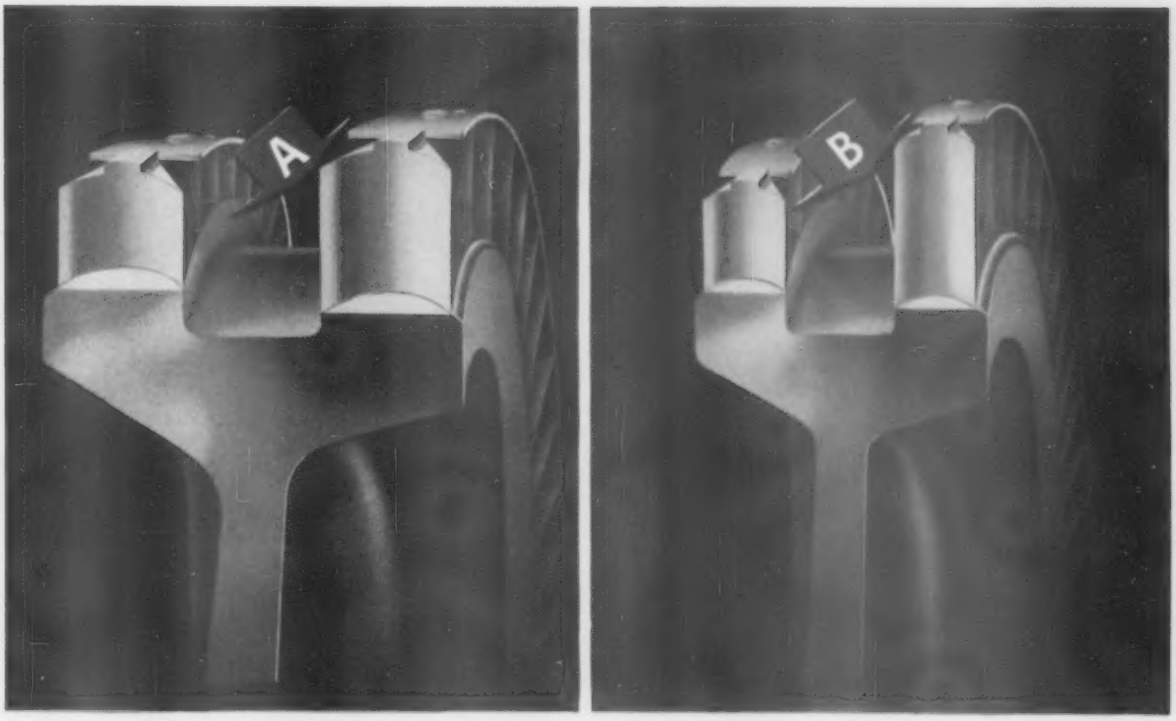

(Left, A) wide bucket "L" type wheel. (Right, B) regular type wheel for Coppus Steam Turbines

Now...for low steam consumption – **COPPUS TURBINES** *can be furnished with wide bucket "L" type wheel*

Good news for steam turbine users where low steam consumption is important!

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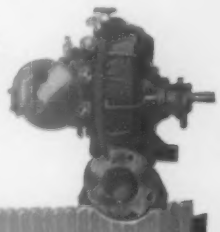
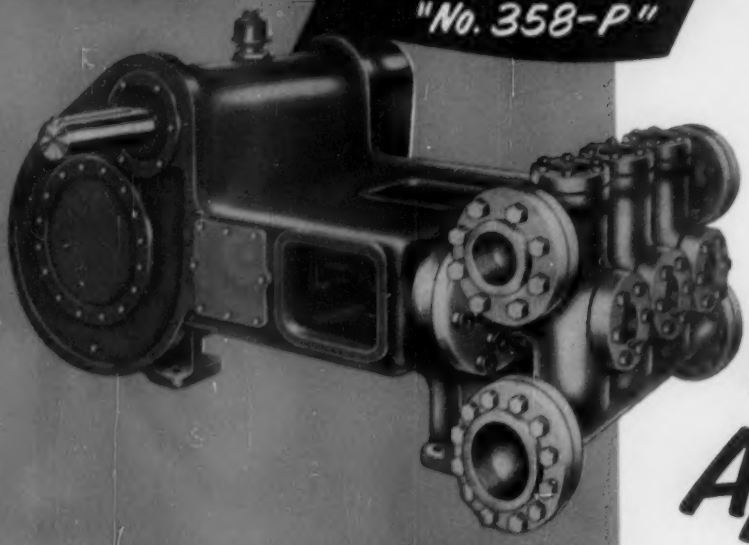


COPPUS "BLUE RIBBON" TURBINES

This New 8" Stroke "No. 358-P" Plunger Pump

extends the "Oilwell" Line for

Waterflood Applications



DISPLACEMENT AND HORSEPOWER REQUIREMENTS

Plunger Size Inches	Maximum Working Pressure psi	NO. 358-P DISPLACEMENT Barrels per 24 hours at Pump Speeds (rpm) of: 75	100	125	150
3¼"	2,410	2,210	2,950	3,680	4,430
3½"	2,080	2,570	3,430	4,290	5,145
4"	1,590	3,330	4,460	5,550	6,680
4½"	1,260	4,250	5,655	7,060	8,460
5"	1,020	4,870	7,000	8,740	10,500
Pinion Shaft RPM Gear Ratio 4.05:1		304	405	506	607
BHP Required		107	142	178	214

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WHEN YOUR WATERFLOOD PLANS call for larger-volume high-pressure injection, it will pay you to investigate the economies of installing fewer "Oilwell" No. 358-P Triplex Plunger Pumps instead of a greater number of smaller units.

This new 8-inch stroke size, like the time-proven 4-inch and 6-inch stroke units, is designed with reduction gear, to provide the pressure-volume desired at slower operating speeds and with a wider selection of prime movers.

With this design, slower plunger speeds with fewer reversals result in less wear on packing, plungers, crossheads and all moving parts including valve service. And, horizontal heavy-duty construction means minimum suction-head requirements, less piping vibration and greater accessibility.

Note these Maintenance Advantages:

(1) Suction and discharge valves are interchangeable and either can be quickly removed for servicing without disturbing the other.

(2) Each stuffing box is removable through the frame cradle for replacement should this become necessary.

(3) Two-piece plunger-and-shank assemblies permit changing of plunger sizes without disturbing the power end and allows use of uncut packing rings.

(4) Crossheads are equipped with adjustable and renewable shoes. Hardened steel, tapered fitted pins are finish ground to size and may be set in either of two positions, 90° apart, to distribute wear.

(5) Wide-faced single-helical gear train is mounted in heavy-duty, adjustable, tapered-roller bearings which have oilbath lubrication.

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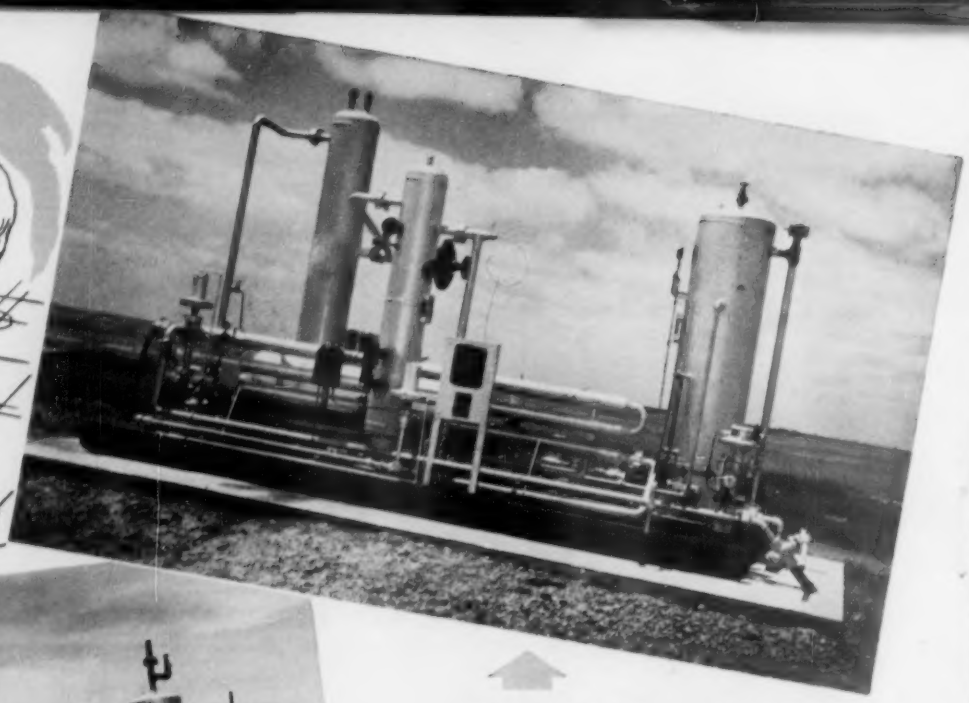
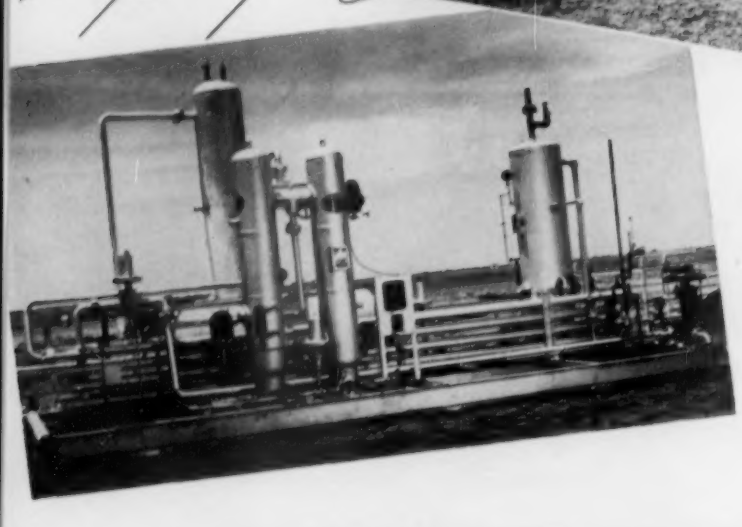


Example of a "custom-built" Parkersburg Hyreco. This 5MMCF unit, 3000 p.s.i. uses the single vertical knockout to meet processing requirements.



Another example of "custom-building" is this 10MMCF, 6000 p.s.i. unit equipped with twin vertical knockouts to meet well requirements.

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● Parkersburg engineers, taking into consideration all the factors affecting gas processing on a specific well, in a specific field, combine the standard elements of Hyreco into the "custom-built" unit that gives you optimum efficiency for that well. You don't have to compromise with performance when you specify a Parkersburg Hyreco Gas Processing Unit.

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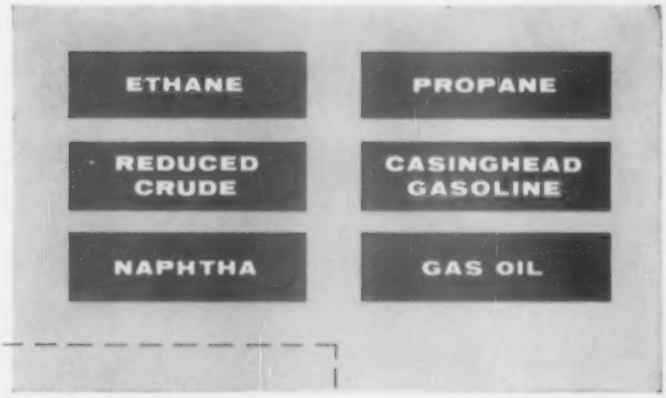
WHATEVER THE FEEDSTOCK FOR ETHYLENE



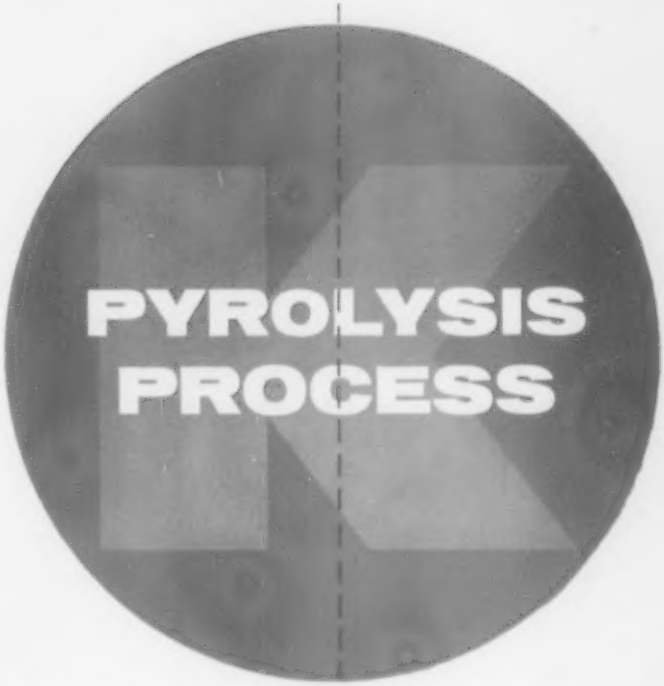
In ethylene manufacture, process engineering by The M. W. Kellogg Company offers many advantages over conventional systems, and guarantees optimum yields and purity from economically available feed stocks.

The key is M. W. Kellogg's steam-pyrolysis process. Used successfully in England for the cracking of heavy naphtha, it permits ethane and propane pyrolysis plants to be designed for higher yields; makes possible the economic production of ethylene and other olefins from casinghead or natural gasoline, residuals, and other low-value products; and indicates that even crude oil can be economically processed to a maximum of olefins instead of to gasoline.

M. W. Kellogg's steam-pyrolysis results have been marked by excellent yields of high purity olefins, generally higher than can be obtained by conventional cracking. This is due largely to the Kellogg process following cracking, where the stream is separated and purified in a low-temperature, low-pressure fractionation system.

Equally important, is the remarkable high on-stream efficiency which permits continuous plant operation at high conversions without the need for spare cracking furnaces.

The M. W. Kellogg Company has accumulated considerable cost data on ethylene manufacture, based on pilot plant and actual commercial production. Interested firms are invited to review these data with M. W. Kellogg chemical process engineers. ***Write for new 8-page folder.***



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Hycar helps drillers hook fish

WITH this new overshot on the end of his string, the driller makes short work of even the toughest fishing job on pipe which sometimes breaks in the hole. One reason is the exceptional ruggedness of the pack-offs, made of Hycar American rubber.

Engineers who developed this unique fishing tool—a circulating and jack screw releasing overshot—ran extensive tests on many types of rubber to find the best one for the important pack-off job. They wanted one that could withstand the abrasives, contact with hydrocarbons, high temperatures, the terrific pressures and stresses encountered in oil field operations.

Hycar passed the lab tests with ease, proved them under actual operating conditions. Hycar performs equally well in many other oil-field jobs, on bridge plugs and blowout preventers, on mud pumps, packers, and pipe-line valves. It can be molded, extruded, shaped to precise dimensions for countless uses.

The unusual versatility and outstanding physical properties of Hycar make it first choice of designers in many industries. It may supply the right answer to one or several of your own problems. For complete information, please write Dept. CG-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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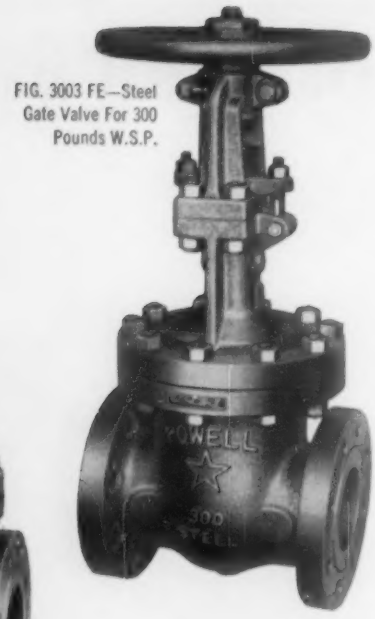


FIG. 3003 FE—Steel Gate Valve For 300 Pounds W.S.P.

FIG. 1561—150-Pound Steel Swing Check Valve.

. . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . .

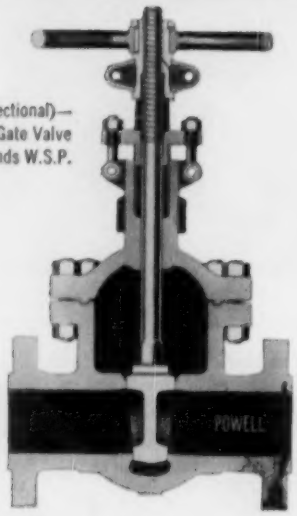
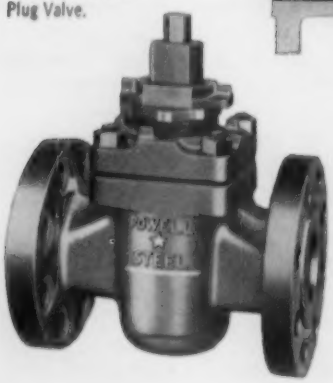


FIG. 6003 SS (Sectional)—Alloy Steel Gate Valve For 600 Pounds W.S.P.

Powell Valves

FIG. 1559—150-Pound Steel Lubricated Plug Valve.



You can depend on outstanding *performance* from every valve made by The Wm. Powell Company, for Powell Valves have a proven record of long life and dependable service.

And Powell Valves give you better *value!* They're precision made and incorporate many quality features—features that can save you money and give you lasting flow control.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *COMPLETE quality line*, and help solve any flow control problem you may have.

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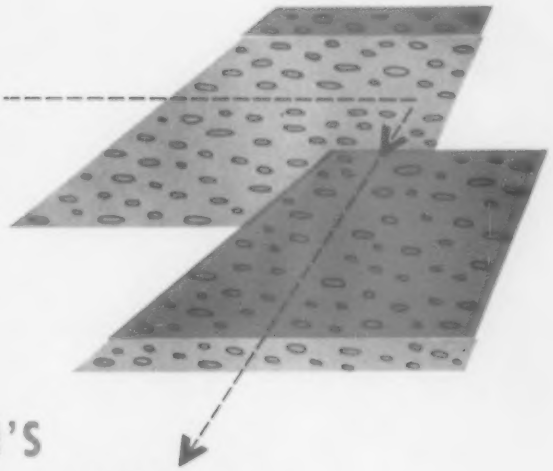


HALLIBURTON'S

delayed action *Acidfrac*

Regular acidizing mixtures react fast when spread thinly in fine crevices—*often too fast* to penetrate deep into new drainage areas. Halliburton's Delayed Action Acidfrac, a new technique that combines the effectiveness of fracturing and acid injection, gives a prolonged action that allows enlargement of flow channels further away from the bore hole. With proper manipulation Acidfrac may cover 400% to 900% more drainage area than is possible with ordinary solutions!

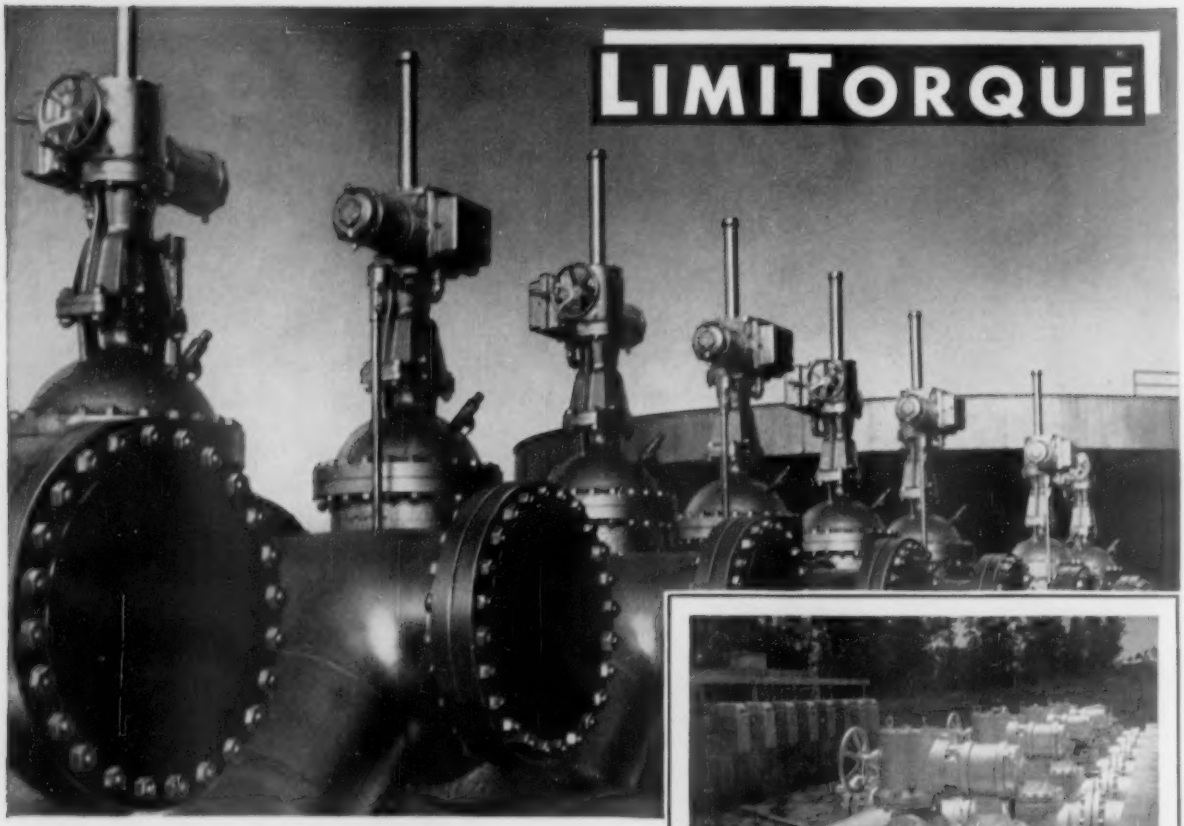
A stable emulsion that can be prepared with a propping agent carries acid into the formation. Reaction starts immediately on contact, but so slowly that after 30 minutes under pressure the solution is still 50% effective. From this point three to four hours are required to finish the reaction in the ordinary fine crevices with sufficient solubility. HCl concentrations as high as 20% may be used to give more limestone consumption and to compensate for the greater travel over a wider area.

Comparative treatments in both oil and gas wells have proved that action which covers a larger drainage area will often give much more production than costly and repeated treatments that confine reaction close to the bore wall. With a great record of success in the field—more oil from 90% of old wells treated and more oil or gas from every well retreated—Acidfrac offers a new and economical method of improving your production. For complete information on Acidfrac and other proved fracturing techniques, call your local or district office of the Halliburton Oil Well Cementing Company.

HALLIBURTON

FRACTURING SERVICES

211 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG



. . . on most of the important oil and gas TRANSMISSION LINES

LimiTorque is the most widely used automatic valve operator in the world. Thousands are operating day and night in Refineries, Central Stations, Private Power Plants and Pipe Lines from Saudi Arabia to Texas. These valve controls are self-contained and are applicable to all types of valves. The wide preference of petroleum and gas pipe line owners and operators for LimiTorque Controls stems from proven performance under all service and climatic conditions.

For all types of pipe line or refining valves . . . LimiTorque can provide the right control. Any available power source such as electricity, air, steam, oil, water or gas may be used.

On many recent pipelines the high pressure gas in the lines has been utilized as a power source.

LimiTorque Motor Operated Valves are readily adapted to Microwave Control.

They operate by the mere "push of a button"

There is no guesswork or labor connected with LimiTorque Remote Valve Control . . . just a push of a button enables one key man to open and close any type of valve quickly and dependably in remote or hazardous locations from convenient and strategically placed control panels. Thus, vital refinery and pipe line operating procedure can be handled easily, safely and give full protection from damage during closing cycle by the torque limiting mechanism.

Send for Catalog L-54 for details.

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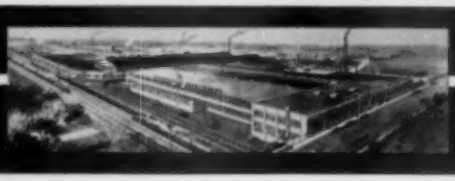
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
LimiTorque Corporation—Philadelphia



Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892

Rugged equipment for rugged country—no matter where the oil is, you'll find dependable Marlow Self-Priming Centrifugal Pumps around the drilling rig. Operators use these job-engineered pumps for rig washdown, brake cooling water, utility water supply and many other applications.

marlows are durable!

Built especially for oil country use, Marlow Self-Priming Pumps and Marlow "Mud Hogs" make a team that can't be beat. Marlows are "old hands" at oil country pumping. They've proved their durability for majors and independents alike on round-the-clock, trouble-free service. That's why more and more veteran oil men are making Marlows first choice. Make sure with Marlow . . . see your Marlow dealer or write for Bulletin O-53.

MARLOW PUMPS • RIDGEWOOD, NEW JERSEY

Division of BELL & GOSSETT COMPANY

FOR LEAKPROOF... CRUSHPROOF TRANSFER OF VOLATILES AND GASES

Penflex Heavy Duty Suction & Discharge Hose

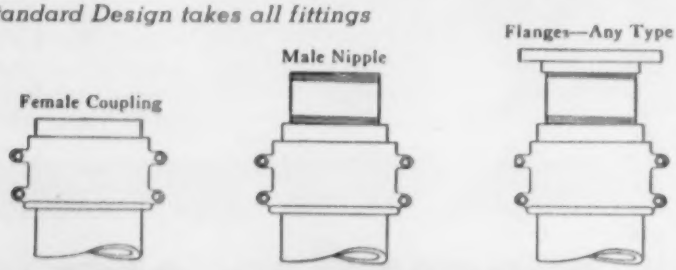
When the transfer of volatile liquids, highly penetrating oils, or gases requires a leakproof pipe and it must be flexible . . . your answer is Penflex Heavy Duty S & D Hose.

This flexible metal, plus rubber hose is outstanding for the routine transfer of hard to hold liquids and gases . . . for the worry-free loading and unloading of oils and gasoline. Penflex Heavy Duty S & D Hose is built to hold anything that will not attack metal.

It combines three way protection for volatiles and gases. The heavy duty, rugged protection of flexible metal hose with a working pressure factor of safety far under ultimate burst. An outer sheath of wire and fabric reinforced synthetic rubber made to take what any truck tire can. Plus the added inherent electro static protection.

Here is a suction and discharge hose made to outwear . . . outlast . . . and outperform all others regardless of construction or make. To reduce hose replacement costs . . . speed loading and unloading . . . and assure leakproof transfers specify Penflex Heavy Duty S & D Hose.

Standard Design takes all fittings



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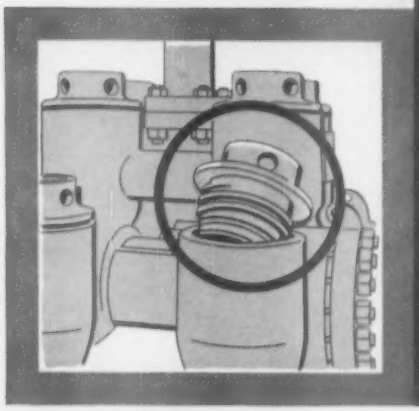
PENFLEX

HEART OF INDUSTRY'S LIFE LINES

NEW EMSCO D-1000

provides the hydraulic power you need



Screw Type Valve-pot Covers. Distinctive one-piece threaded valve-pot covers provide quick and easy access to valves . . . reduce bulk and weight.

EMSCO

EMSCO MANUFACTURING COMPANY

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Emsco's new D-1000 will give you the high pressures and volumes you need for jet bit, big hole and deep drilling for present day operations.

The Emsco D-1000 is rugged and dependable, yet lightweight for its power rating. Fabriform construction of the power end utilizes steel plates and shapes in place of bulky, heavy iron castings. This permits easier, more economical transportation and rigging up.

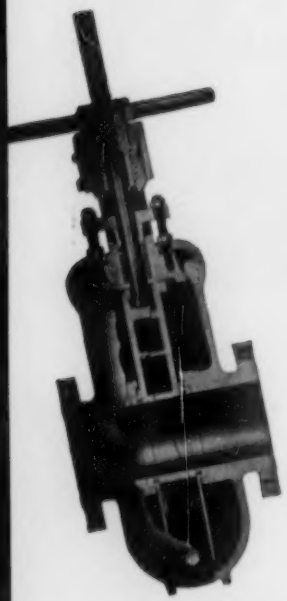
Emsco D-1000 Power Slush Pumps are simple and easy to install, operate and maintain. There are no power end adjustments to be made — no greasing to be done, because the lubrication system is completely automatic. Emsco's patented "exposed" liner design eliminates all fluid washouts caused by liner packing failure, since the slightest leak may be detected and packing replaced before washout occurs.

There's an Emsco slush pump to meet every drilling requirement. Call your Emsco representative for details.

E-205-55

W-K-M PROCESS VALVES FOR GASOLINE PLANT SERVICE

When you figure that W-K-M Process Valves have metal-to-metal seals to provide complete safety under any conditions, that they permit full pipe-diameter flow without turbulence, that positive opening and closing are guaranteed by W-K-M's exclusive Leverlock design, that they can be completely overhauled with very little trouble while on the line, that they are available in any trim for any process service—high pressure hot or low pressure cold—it is no wonder that more and more gasoline plants and refineries are specifying W-K-M for the key jobs—and some plants use them all the way through. Write for Bulletin 698 for the complete data about these valves or ask for a W-K-M sales engineer to sall.



At left is cutaway section of the W-K-M Process Valve. Shown below is drawing of the exclusive W-K-M Leverlock mechanism which guarantees positive opening and closing under all conditions.

W-K-M Valves

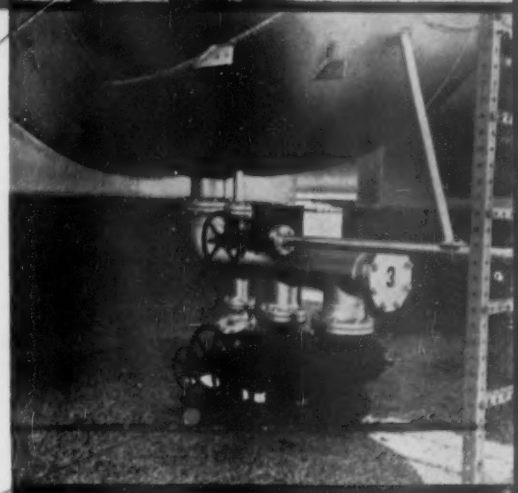
W-K-M Manufacturing Company, Inc.

A subsidiary of ACF Industries Incorporated

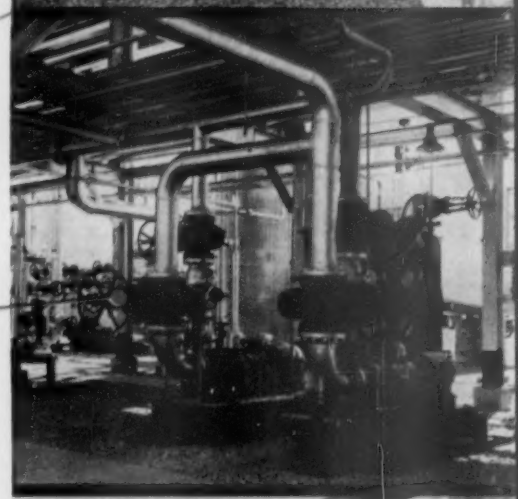
P. O. Box 2117, Houston 1, Texas Los Angeles, California

Export Office: 45 Rockefeller Plaza, New York, N. Y.

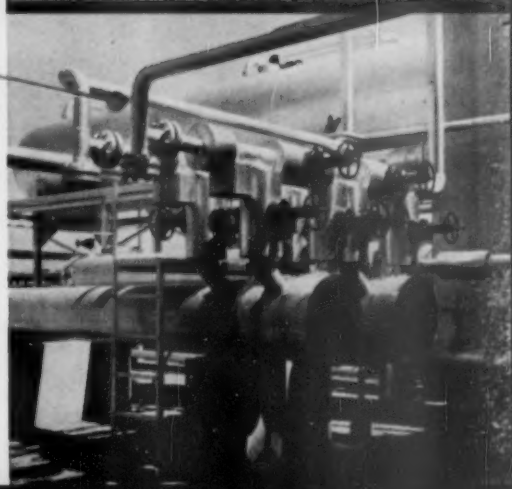
These valves and those shown below are in a gasoline plant in West Texas. Reading from left to right in above photo, the valves are in service on loading pumps handling butane, at 125 psi ga., 85° F; gasoline, 75 psi ga., 85° F; propane, 225 psi ga., 85° F.



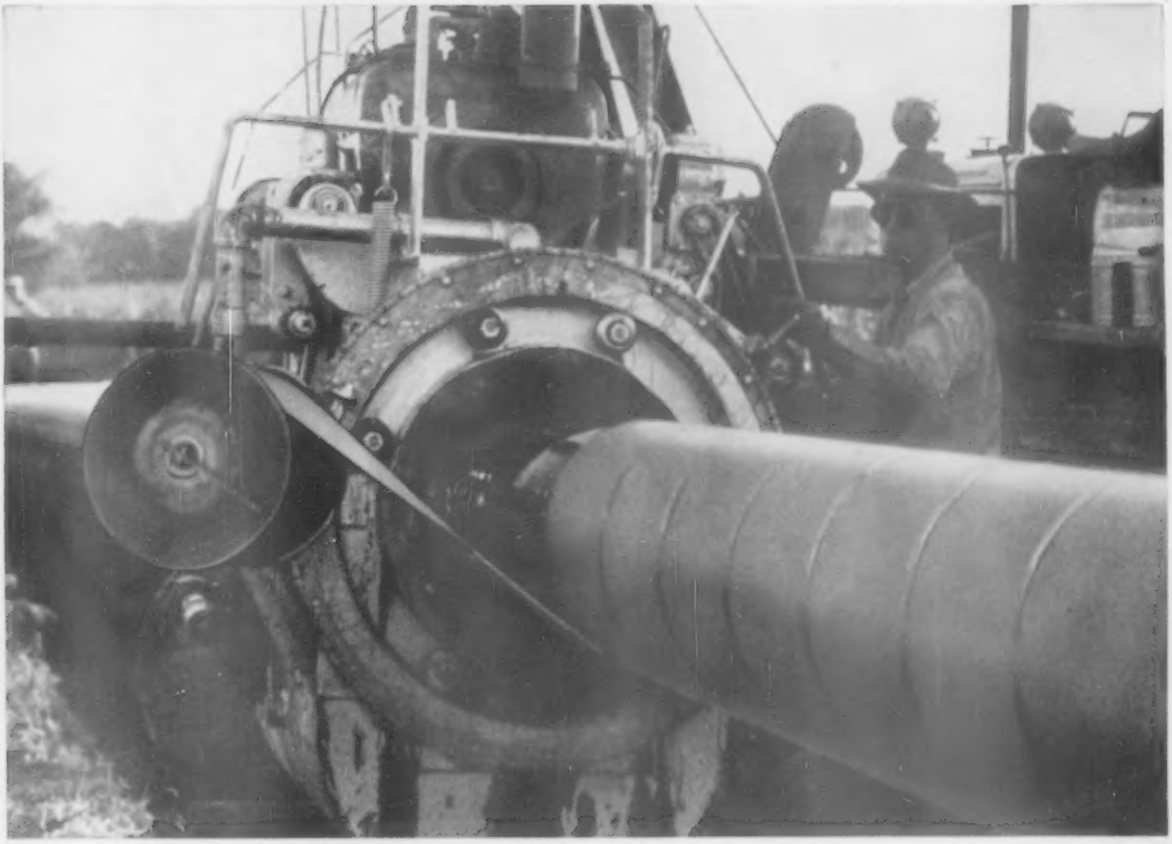
W-K-M Valves on butane stock tank at 125 psi, 80° F. Four valves are used on each tank and there are ten tanks.



These valves provide reflux to propane fractionator. They handle propane at 275 psi ga., 108° F.



These jacketed valves handle unstabilized gasoline at 550 psi ga., 260° F. in deethanizer feed exchanger.



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There are many reasons why NO-OX-ID has widespread preference among pipeline contractors, coating crews, independent applicators and utilities.

- NO-OX-ID saves on material, because less material coats more pipe per mile per day. Fewer "dope" kettles, trucks and "cats" are needed.
- NO-OX-ID is applied by hand, by Traveliner or at the mill.
- No irritating or noxious fumes with NO-OX-ID.

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MAIL THE COUPON for booklet "Protecting Underground Pipe from Corrosion." It contains detailed information on NO-OX-ID and NO-OX-ID Casing Filler.

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Dearborn NO-OX-ID®

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Dearborn NO-OX-ID CM Casing Filler

NO-OX-ID CM Casing Filler protects against corrosion wherever pipelines are cased beneath highways and railroad crossings. CM Casing Filler (1) contains additives, inhibitors, wetting agents; (2) displaces water up to 5% of its own weight; (3) is applied at 150° F; (4) is an electrical insulator; (5) is economical to apply.

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V-TYPE ENGINES

Nordberg *Supairthermal* V-type engines are built with 10, 12, 14 and 16 cylinders, offering a range up to 5000 hp per engine . . . for Diesel, Duafuel® or Spark-Ignition Gas operation.

(Illustrated is a typical 12-cylinder, 2650 hp *Supairthermal* V-type Diesel engine in pipe line service.)

NORDBERG *Supairthermal*® ENGINES

the logical choice for

PIPE LINE POWER

● On today's modern pipe lines, the trend is toward Nordberg *Supairthermal* engine power. The reasons are simple and sound . . . these compact engines produce *more* power in *less* space—substantially reducing installation and operating costs. What's more—the efficiency of these powerful engines turns low fuel consumption rates into *profit dollars* at the end of the line.

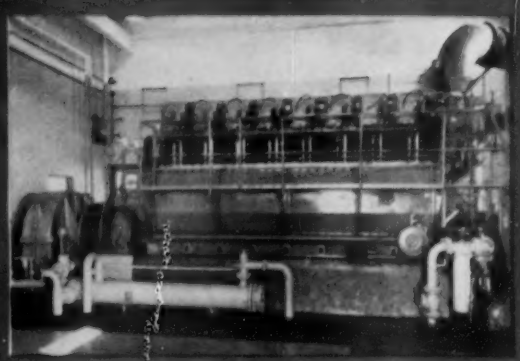
Hundreds of Nordberg engines are daily furnishing continuous, dependable pipe line power in a wide variety of installations . . . from pumping and generating units in permanent trunk line stations, to self-contained portable units for production pumping. Evidence that you will benefit by discussing your power problems with experienced Nordberg engineers.

NORDBERG MFG. CO.
Milwaukee, Wisconsin, U.S.A.

IN-LINE ENGINES

Nordberg *Supairthermal* IN-LINE engines are built in 9" and 13" bore sizes, developing from 535 horsepower upwards . . . for Diesel, Duafuel® or Spark-Ignition Gas operation.

(Illustrated is a typical 8-cylinder, 13" bore *Supairthermal* Spark-Ignition Gas engine operating on a large products pipe line.)



NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

© 1955, Nordberg Mfg. Co. O455

Mack six-wheeler recently added to fleet of Jess Edwards, Corpus Christi, Texas.

they get the calls for the toughest hauls!

Ask someone like Jess Edwards—a ten-state oilfield contractor—why he keeps on using Macks. You can bet it's because he's sold on their performance and economy.

He'd have good reason for saying so, too. Mr. Edwards has had Macks working for years under extremes of weather and road conditions in his 125-unit fleet operation. He knows from experience that there's nothing like a Mack for ruggedness, dependability and long life.

Take the Mack Balanced Bogie and Power Divider, for example. This exclusive combination gets a Mack six-wheeler through even the toughest spots. It's one of many reasons why Macks get the job done—and fast.

Why not put a Mack on *your* hardest hauls? Keep a strict check on its every job . . . count the time and money you save every day. Then see if you don't agree —it pays to invest in Macks.

MACK TRUCKS Empire State Building, New York 1, N. Y.

3131

Adjustable-speed Gýrol Fluid Drive

controls the flow in catalytic reforming processes

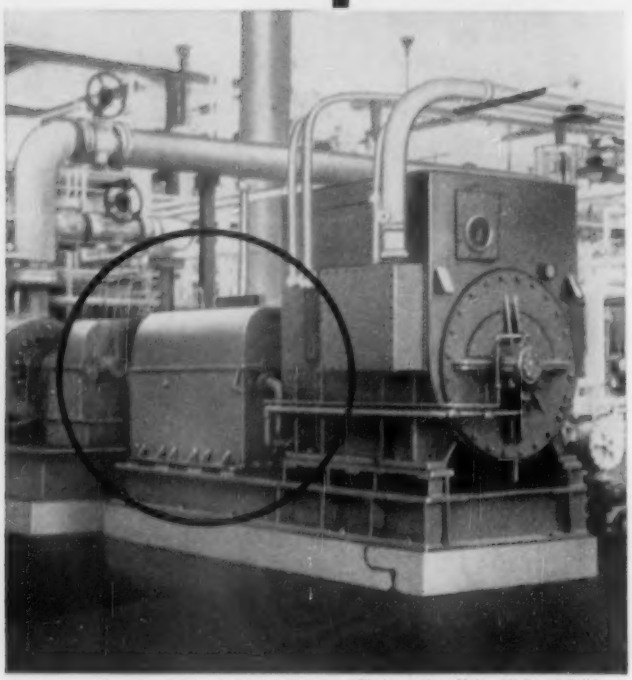


Photo courtesy Union Oil Co. of California

Unit shown is a 4000 hp, 1800 rpm, size 315, type VS, Class-6 Gyrol Fluid Drive equipped to automatically regulate the speed of a centrifugal compressor handling variable-density gases.

Accurate control of the flow of gases and fluids is the key to the successful operation of a catalytic reforming plant. Because its speed is *adjustable*, American Blower Gýrol Fluid Drives can vary the flow rates of compressors and pumps of all sizes and types — *as needed*. Consider these inherent advantages of Gýrol Fluid Drive:

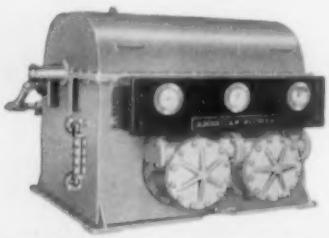
- Provides infinite and accurate pump speed adjustment over a wide range
- Simplifies starting equipment — provides no-load starting
- Eliminates problem of "gumming" which may occur with mechanical dampering
- Saves steam needed for process work through use of squirrel-cage, constant-speed electric motor
- Permits automatic control. Flow rates can be automatically regulated by simple movement of one push-pull control rod

Whatever your method of catalytic reforming, use Gýrol Fluid Drives for flow-rate control. Call your nearest American Blower Branch Office for data.

Traction-type Fluid Drives

American Blower Type TM, traction-type fluid drives are also available as complete packaged units containing AC motor and built-in Gýrol Fluid Drive. Standard NEMA mounting bolt hole dimensions. 1 to 20 h.p.

Type VS, Class-2, adjustable-speed Gýrol Fluid Drive. Speed range: 5 to 1. Six sizes, 7½ to 800 hp; speeds to 1800 rpm.



Type VS, Class-6, Gýrol Fluid Drive. Adjustable-speed drive for compressors, pumps, and other high-speed applications. 200 to 12,000 hp; to 3600 rpm.

American Blower products serve the petroleum industry

- Air Conditioning, Heating, Ventilating Equipment
- Mechanical Draft Equipment
- Industrial Fans and Blowers
- Centrifugal Compressors
- Gýrol Fluid Drives

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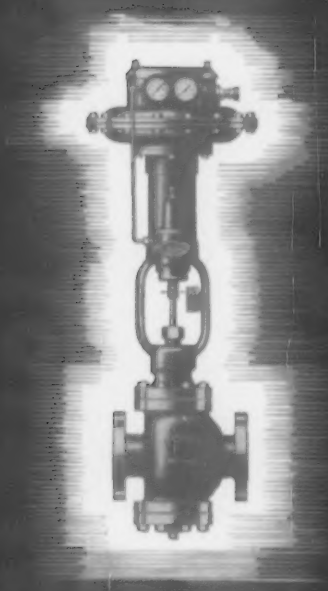
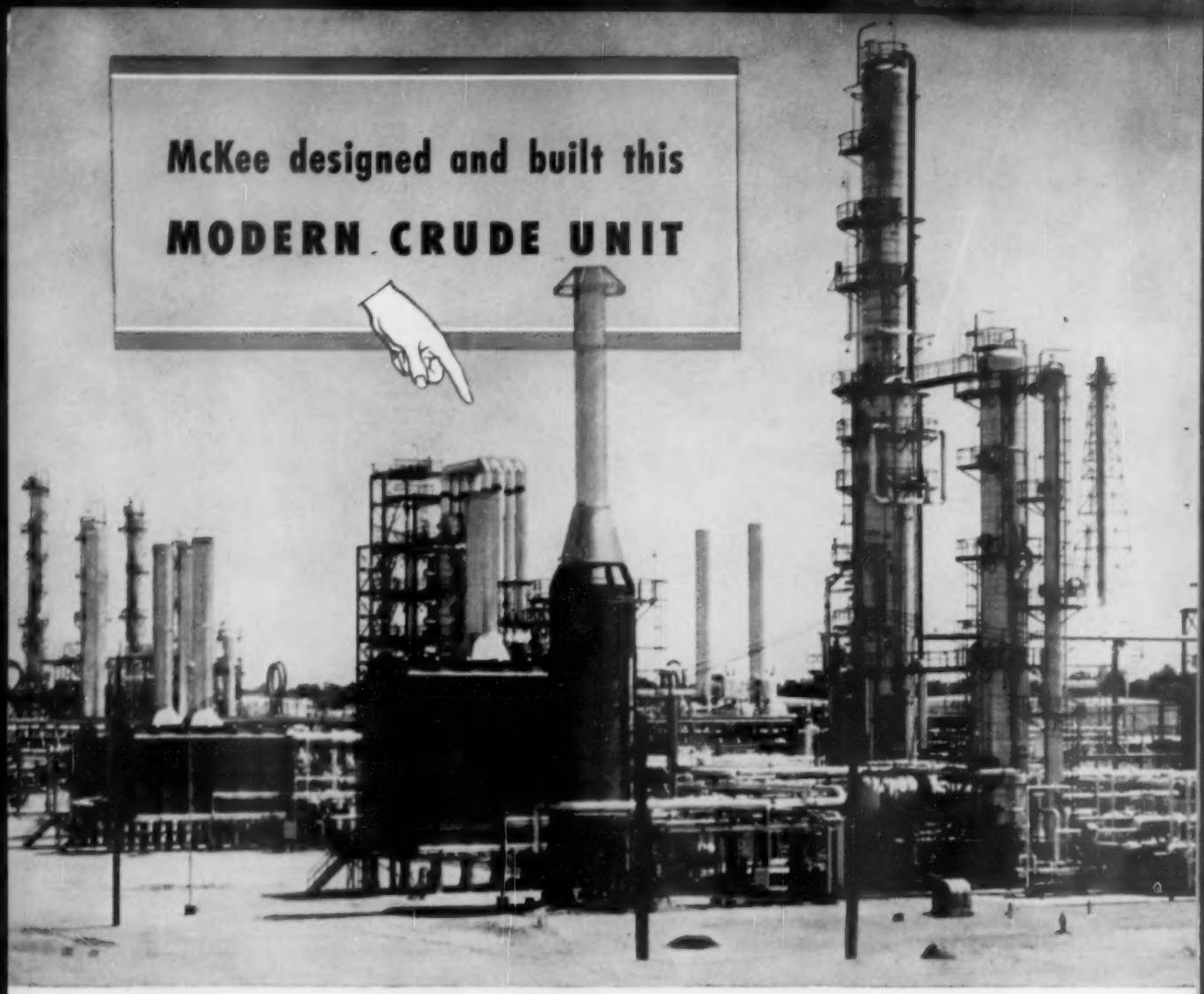


FISHER WIZARD - - - *UNIVERSALLY ACCEPTED AS THE WORK HORSE ON SIMPLE PRESSURE CONTROL JOBS*

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL



...but McKee engineers are already working to improve the next

MAKE no mistake—the McKee men who engineered this plant put everything they had into it—expert knowledge, long experience, conscientious effort and great enthusiasm. It's the most modern and efficient plant of its kind—but McKee engineers are never satisfied. They're working now to find a better design, a more efficient layout, a faster, more economical method of construction for the next project.

That has been the story of McKee for half a century—a constant striving for improvement in design and methods. That's why, even though McKee engineers are never satisfied, McKee customers *always* are.

50th ANNIVERSARY

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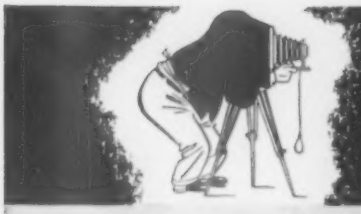
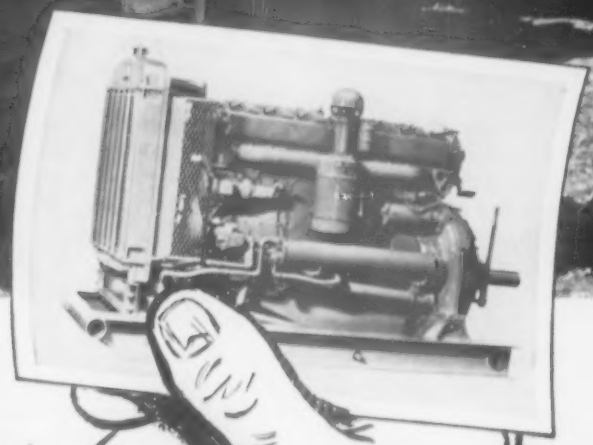


MURPHY DIESEL IN THE PICTURE

Two Murphys power this rig owned by Leon C. Smitherman Drilling Co.



...makes more hole at less cost

The best rig in the world can't be any more efficient than its power plant. And that's why more and more drillers are turning to Murphy Diesel Power. Heavy duty Murphy Diesels offer an exclusive combination of design features that make it possible for you to make more hole per dollar of power costs. With Murphy Diesel in the picture you get greater fuel economy, longer life and dependability unmatched by any other engine of comparable size. Ask your Murphy Diesel Dealer to give you the whole story.

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TULSA, OKLAHOMA, SALES, PARTS AND SERVICE—113-117 S. ELWOOD ST.

VALVES AND FITTINGS

. . . SINCE 1842!

The Amazing Facts About
WALWORTH

The 1840's were eventful years. From Washington to Baltimore Morse sent his first message: "What hath God wrought!" In that decade we found the Antarctic Continent, opened the Naval Academy in Annapolis, declared war on Mexico, sold the first adhesive postage stamps, discovered gold in California. And in 1842 WALWORTH, now the oldest manufacturer of valves and fittings in the United States, set up business in the heart of Boston.

WALWORTH is a bright pattern in the fabric of American industry. To engineers in oil and gas, and to men in these industries who buy for replacement, WALWORTH on valves and fittings is as standard as Sterling on silver.

The amazing range of types, sizes and materials in the WALWORTH line never fails to delight men who know and must depend on valves and fittings in the presence of endless products, pressures, and temperatures. The line is so diversified and so ingenious that many of the machines used to manufacture WALWORTH products must be designed and built by the Walworth Company.

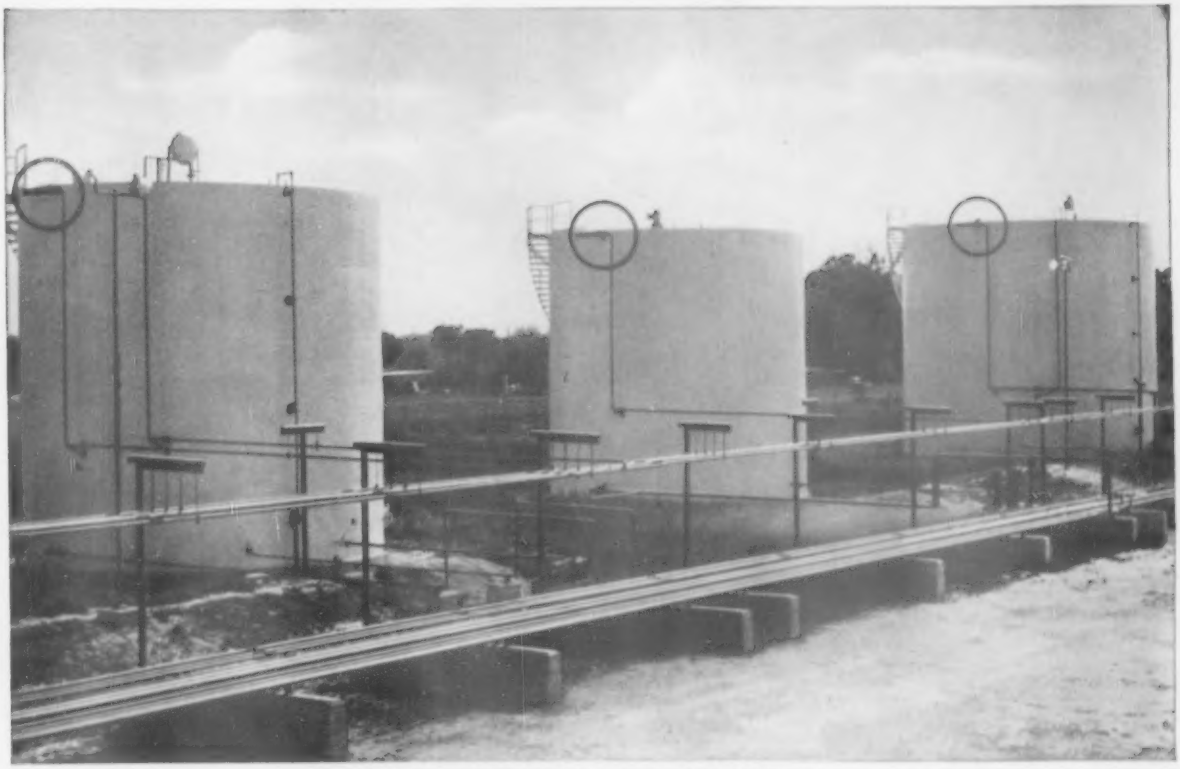
To specify WALWORTH is to tap the mother lode of knowledge and experience in Valves and Fittings.

MALLEABLE FITTINGS
WALWORTH 300 MALL
Steel Ball Bearing Lubricated Plug Valve
Iron Body Swing Check Valve
WALWORTH
Cast Steel Gate Valve
Through-port Type 49 Steel Pipe Line Gate Valve

J&L STEEL

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION – TULSA, OKLAHOMA
Serving The United States and Canada

117-G



Rockwood Double Barrelled Foam Maker Chambers (circled) guard oil storage tanks in a southern refinery above.

The bubbles that keep oil safe

The tube-like objects circled in the photograph above have a special way of generating bubbles that safeguards the oil within the storage tanks.

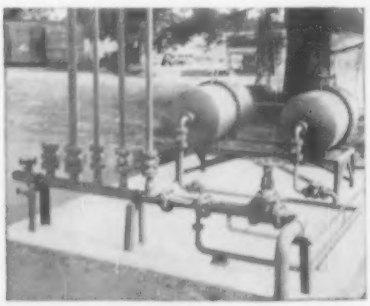
Should fire break out, these tubes — Rockwood Double Barrelled FOAM Maker Chambers — will swiftly pour a smothering FOAM blanket over the flames, controlling and extinguishing the fire. What's more, they pour a denser type of Rockwood FOAM blanket than ordinarily produced.

Inside each tube are two concentric barrels, one within the other. Internal impinging jets discharge into these barrels, dynamically mixing air, water and FOAM into a finer bubble structure than ordinarily possible and thus producing the extra-dense blanket that keeps oil safe.

This patented construction of Rockwood Double Barrelled FOAM Maker Chambers is typical of the careful way in which Rockwood engineers every detail of a Rockwood SpotPROTECTION System. These systems take the danger out of danger "spots", protect lives, property, money. Take advantage of them for your own protection.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses



These Rockwood SpotPROTECTION Liquid Storage Tanks contain Rockwood FOAM. A balanced pressure proportioning system automatically proportions the FOAM into the water. This properly balanced mixture is then fed into the system that protects the tanks.

Rockwood Double Strength Foam clings to metal surfaces as an insulator — FOAM Liquid flows freely at sub-zero temperatures. Excellent for extinguishing fires in gasoline, benzol and other highly volatile liquids as well as ordinary combustibles.

SEND FOR THIS INFORMATIVE BOOKLET

ROCKWOOD SPRINKLER COMPANY
626 Harlow Street
Worcester 5, Mass.

Please send me your illustrated booklet on Rockwood fire-fighting products.

Name_____

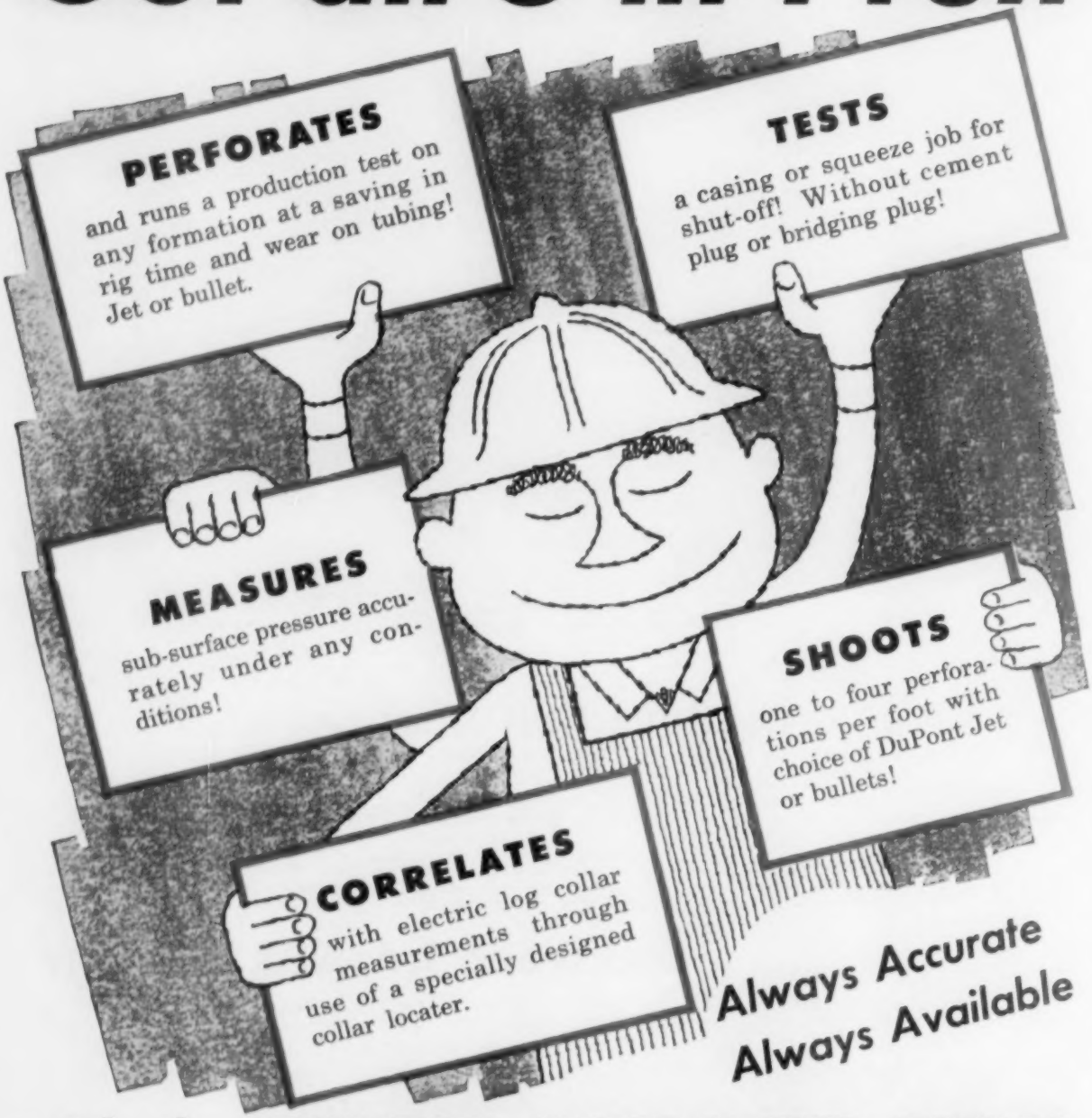
Title_____

Company_____

Street_____ City_____

Zone_____ State_____

Get all 5 in 1 run


PERFORATES
and runs a production test on any formation at a saving in rig time and wear on tubing! Jet or bullet.
TESTS
a casing or squeeze job for shut-off! Without cement plug or bridging plug!
MEASURES
sub-surface pressure accurately under any conditions!
SHOOTS
one to four perforations per foot with choice of DuPont Jet or bullets!
CORRELATES
with electric log collar measurements through use of a specially designed collar locater.

Always Accurate
Always Available

with the JOHNSTON SHOOT-N-TEST METHOD

Write for free booklet JPS on Perforating

JOHNSTON TESTERS

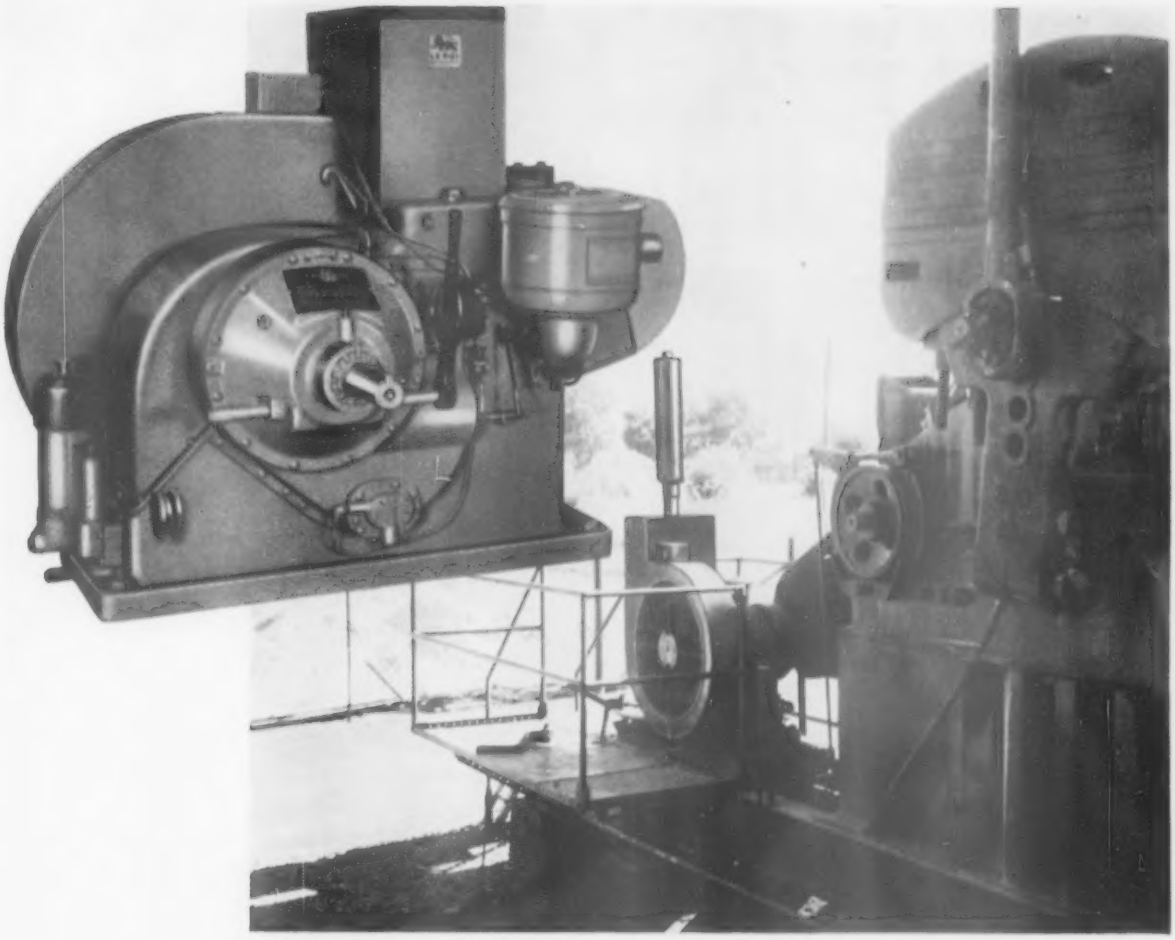
first in drill stem testing

HOUSTON, TEXAS

LOS ANGELES, CALIF. • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON

P 551



Total Operating Cost Only 12 Mills per Hp Hour

...that's why it pays to do your pumping with Le Roi A288's

ACCORDING to the major oil company using this 26.3 max. hp A288, this operating cost is lower than that of any of their other engines.

And here are some of the reasons why the A288 cuts the cost of pumping — why it can run two weeks at a time without inspection.

Patented, "vaporizing-condensing" cooling system seldom needs make-up water. Uniform high temperatures reduce corrosion and sludging.

No superfluous acccessories like grease fittings, conventional-type fan and belts to need attention.

Generous crankcase permits long intervals between oil changes — and no shutdown is required to inspect oil level or add oil.

And performance-wise, you can't beat the A288, or the smaller 14.9 max. hp A114 sister engine, either. One typical installation has more than 47,000 hours on it. Stamina like this is one reason why the A288 is the only pumping engine recommended by a major user for continuous service *unattended for up to two weeks' time.*

Standardize on A288's and watch your pumping costs drop. You can get them from your supply house, or your Le Roi distributor. Or write us for our latest bulletin.

LE ROI *Division of Westinghouse Air Brake Co.*

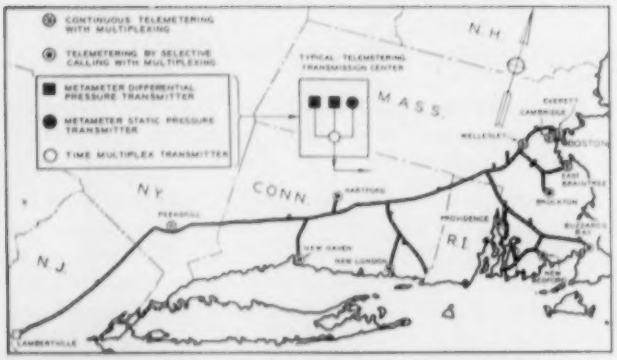
Milwaukee 14, Wisconsin

P-138

WHAT'S NEW AT BRISTOL...

EASY-TO-READ Bristol Metameter Telemeters at Algonquin Gas continuously record information on twelve measurements of static and differential pressures in the Boston area. Bristol Multiplex receivers (bottom row) segregate incoming signals and direct them to proper receivers.

Continuous, system-wide telemetering pays off for Algonquin Gas



MAP SHOWS Bristol telemetering equipment on the Algonquin Gas Company's pipeline.

Every gas company sells two commodities. Gas – and service. *Reliable* service. Service that builds confidence. Service that turns prospects into customers, customers into friends.

How to achieve this kind of service? The Algonquin Gas Transmission Company of Boston finds the answer in a Bristol Metameter® Multiplexing Telemetering system. With the help of the Bristol installation, Algonquin can supply gas to its customers at pressures which the customers have determined are best for their operation – with an absolute minimum of service discontinuities.

Why Bristol equipment? Because Algonquin felt it was simply good business to deal with the acknowledged leader in telemetering equipment. Let us tell you how Bristol's 65 years of instrument experience can help you, too. Write for Bulletin M1710 to The Bristol Company, 120 Bristol Road, Waterbury, Conn. 4.38

BRISTOL'S

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

These companies too use non-corroding KRALASTIC pipe

chemical pumping... **OLIN MATHIESON CHEMICAL CORP.,** Baltimore, Maryland. Kralastic replaces 3,000 ft. of rubber-lined steel for piping 25% ammonium sulphate—installed 1953.

oil-flow lines...THE OHIO OIL CO., Robinson, Illinois. Kralastic pipe replaces 12,000 ft. of steel pipe—installed February 1954.

salt-water disposal...NATIONAL COOPERATIVE REFINING ASSOCIATION, Wichita, Kansas. 50,000 ft. of Kralastic pipe for salt-water disposal and oil-flow lines—since 1951.

But WHY Kralastic for severe corrosive conditions?

BECAUSE Kralastic pipe *can't rust or rot*—is free from electrolytic action—highly resistant to most chemicals, to scaling and paraffin build-up—impervious to water and soil elements. And it never needs coating, lining, or anode protection. In addition, the extremely smooth internal walls minimize back pressure.

A unique combination of plastic and elastomeric materials, Kralastic offers superior physical properties that no other pipe material can match. The resin-rubber blend makes Kralastic *hard, tough,* and resistant to most chemicals. It also gives Kralastic extremely high impact strength—even at Arctic temperatures. The butadiene type rubber used is oil and chemical resistant.

Kralastic pipe can be quickly and easily solvent welded by unskilled workers. Or it can be threaded for use with threaded fittings. Because Kralastic® is unusually light weight (about 1/7th the weight of iron pipe) you need no heavy handling equipment—no costly bedding.

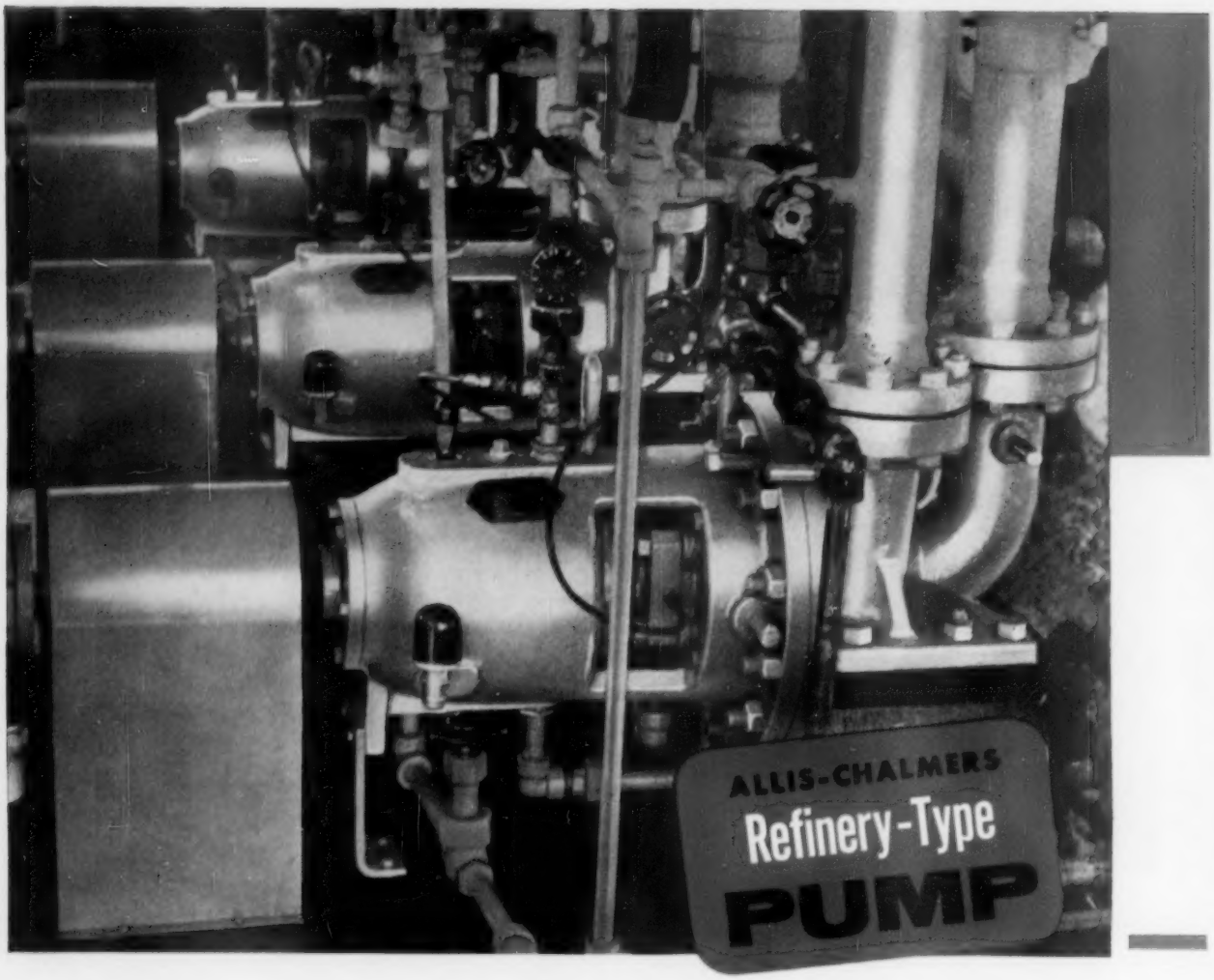
For more about this amazingly tough and durable plastic pipe material and the advantages it offers you, write to us on your company letterhead, today.

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N.Y.

Sun Oil uses



Ample Reserve Strength in Every Detail of Construction

Sealing — Various types of packing and mechanical seals or combinations of both can be obtained to suit the application.

Cooling of stuffing box and bearings can be provided by water or oil, in five separate places. Water-cooled pedestal available for extremely high temperature operation.

Wearing rings, front and rear, are provided on both impeller and casing.

Shaft and bearings are of exceptionally heavy design to reduce deflection and vibration, assure long wear, low operating costs.

Throat bushing and base ring are renewable. Close fit on shaft reduces infiltration into stuffing box. Cannot blow in or out.

Double volute casing used on pumps above 400 gpm greatly reduces deflection forces. Low NPSH design successfully handles highly volatile liquids at high temperatures.

ALLIS-

eleven of these pumps

Where Service Continuity Is Essential

ELEVEN of these Allis-Chalmers refinery-type pumps are installed on a variety of continuous duty applications at a refinery of the Sun Oil Company, Limited. They are top suction, water-cooled units with standard high temperature packing. These pumps have the stamina to keep going on the toughest applications for years without down time. Every construction detail has been carefully engineered to provide ample reserves of strength and durability.

wide choice of materials and features

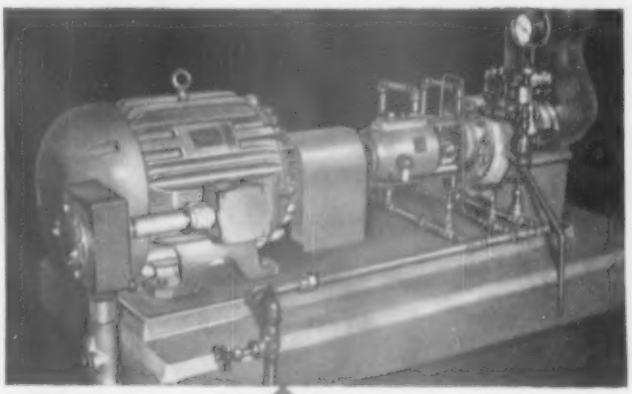
The Allis-Chalmers refinery pump can be fitted to suit your requirements exactly. Practically any material normally used in pumps may be specified. Stuffing box takes packing, mechanical seal or both. Cooling water or oil may be used in five separate places, so you can select exactly the cooling arrangement for your particular needs. Suction may be at top or on end.

get complete information

Your nearby Allis-Chalmers representative will be glad to help you with your refinery pump problems. Or write for Bulletin 52B7775. Allis-Chalmers, Milwaukee 1, Wisconsin. A-4557

get complete unit / pump motor control

Allis-Chalmers will supply a complete pumping unit — pump, motor and control — engineered to work together and with pump and motor mounted on a single base plate ready for installation. You save engineering time because you don't have to match components from different manufacturers. You save purchasing time — only one order. And, most important, you are sure that the components will work together to give you long life at low operating cost. The complete unit is covered by a single guarantee backed by Allis-Chalmers well-known customer satisfaction policy.



CHALMERS

A-C ALLIS-CHALMERS

Make All Your Low Pressure Hose Lines from This *NEW* Aeroquip Kit

SPEED REPLACEMENT! CUT COSTS! REDUCE INVENTORY!

DURABLE ALL-STEEL BOX

JUST PUSH Aeroquip 1525 Hose on the SOCKETLESS Fitting . . . It Stays On Even at Pressures as High as 250 p.s.i.

PATENT APPLIED FOR

Back of fitting tray can be raised for convenient use

Kit 5144 contains 93 fittings and adapters in 20 sizes and types

Compartment of Kit 5144 contains 24 ft. of ¼" hose, and 24 ft. of ⅜" hose

Pull out hose, measure it, and cut with knife

Many users have requested a permanent-type container for Aeroquip *SOCKETLESS* fittings and hose. So this durable all-steel Kit 5144 is now available. It contains an inventory of hose, fittings, and adapters in types and sizes that will meet practically all low pressure applications.

With remarkable new Aeroquip *SOCKETLESS* fittings and hose, fuel, oil, water, and air lines can be made and installed *extra fast* on all kinds of industrial and mobile equipment. Field replacement is simplified because Kit 5144 is compact (12½" x 12½" x 6½" when closed) and it will stand up in field service.

Aeroquip *SOCKETLESS* fittings and hose are saving time and money for users in every industry. Get the complete story from your Aeroquip distributor, listed in your Yellow Page Directory, or write us.

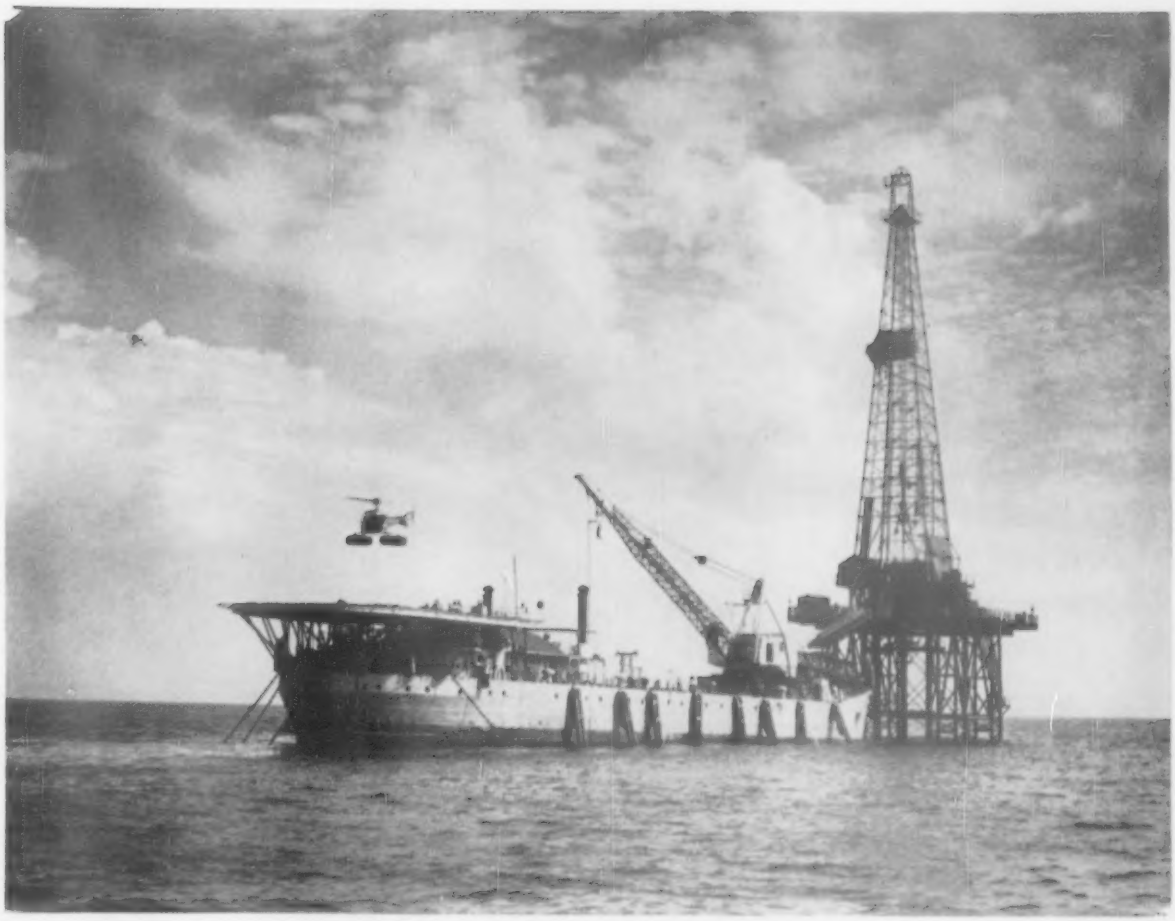
Also Available: 15-Cell Kit No. 5143 with 24 feet of ¼" hose and 71 fittings and adapters in same box.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD



versatile

reclaimable

Picture shows small exploratory type structure for use with drilling tender.

This setup reduces cost of "wild-cat" operations and is reclaimable for use at future locations.

W. Horace Williams Company's design is readily adaptable to varying depths of water, giving added utility to reuse.

As many as six wells may be drilled from this size structure.

The platform may, at any time, be added to for use as a production platform or for a "self-contained" operation, freeing the tender for use elsewhere.

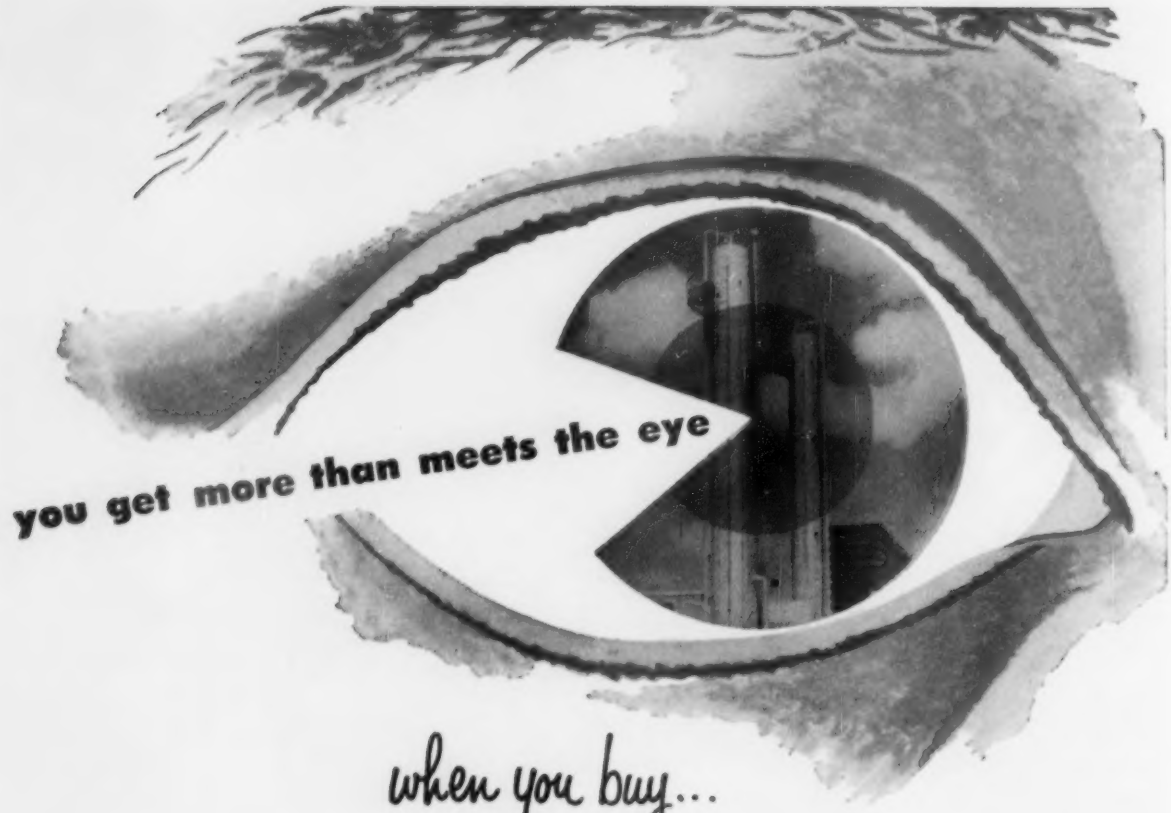
W. HORACE WILLIAMS COMPANY

ENGINEERS INCORPORATED GENERAL CONTRACTORS

833 Howard Ave. Ph. RAymond 1291

Marine Contractors Since 1908
NEW ORLEANS

OFFSHORE STRUCTURES, WHARVES, BULKHEADS, FOUNDATIONS



when you buy...

MONOETHANOLAMINE
DIETHANOLAMINE
DIETHYLENE GLYCOL
TRIETHYLENE GLYCOL

from **CARBIDE**

Yes! You get *more* than drums and tank cars of the best gas-treating chemicals . . .

YOU GET . . .

- the results of CARBIDE's 20 years' experience in their manufacture.
- the service of CARBIDE's field representatives.
- the assistance of CARBIDE's laboratories where specialists devote a great amount of time to work on customer service problems.
- the benefit of CARBIDE's knowledge about the handling, properties, and use of these chemicals.
- the assurance of availability and fast service through CARBIDE's national distribution network of 50 warehouses. (In Canada: Harrisons & Crosfield's.) Shipments are made in tank cars, tank wagons, and drums in carload or truckload lots.

REMEMBER: You get more than chemicals when you do business with CARBIDE.

CARBIDE AND CARBON CHEMICALS

Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street New York 17, N. Y.

LADISH

MULTIPLE OUTLET HEADERS

TO MARK PROGRESS

Simplify

PIPE LINE GATE SETTINGS

Ladish Multiple Outlet Headers provide seamless outlets in exact location for by-pass, blow-down and service line connections . . . eliminate costly and undesirable practice of nozzling-in branch connections and saddle reinforcements.

Ladish headers . . . available in virtually any variation of size, number or location of outlets, diameter and length of run . . . are a significant development resulting from co-operation of pipe line engineers and Ladish engineering experience and manufacturing facilities.

Other Ladish developments for the Pipe Line Industry include—HOT TAP REINFORCING TEES, EXTRA LONG RADIUS (3R) ELBOWS, ANCHOR FLANGES.

- **Save 70% in Welding Time***
- **Streamline Design of Gate Settings**
- **Eliminate Reinforcing Saddles**
- **Speed Construction**
- **Simplify Installation**

*REFERENCE: Panhandle Eastern Pipeline Co. article in March 7, 1955, Oil & Gas Journal. Reprints on request.

THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland
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an **ACCO** product

American Cable
TRU-LAY VHS

15% Stronger
It's Tougher, too!
Read How It Lowers Wire Rope Costs

For Rotary Drilling Lines

TRU-LAY VHS is the new wire rope everyone is talking about. It's working on many rigs and it's making new friends every day.

Like all TRU-LAY ropes it's preformed. But it is 15% stronger than rope made of Improved Plow Steel which was the strongest available up to now. It is also tougher.

The name VHS means Very High Strength. This new rope is knocking all past records into a cocked hat. It is so good the mill has a hard time keeping up with demand. It offers these important advantages:—

Higher Factor of Safety

Careful calculations show that the factor of safety for 10 lines of TRU-LAY VHS rope is 14.9% or 15% higher than for 10 lines of IPS rope. It is also noted that the factor of safety for 12 lines IPS is almost identical to 10 lines of VHS rope.

Faster Drilling Possible

With stronger VHS you can make round trips faster and drill to greater depth before increasing the number of parts of line.

Better Spooling on Drums

In addition to its greater strength, new TRU-LAY VHS is also tougher and has greater resistance to abrasion. It resists deformation . . . keeps its shape for longer periods of service . . . spools better on drums.

More Ton Miles Possible

Its extra toughness and greater resistance to abrasion and wear means longer life. By following a recommended cut-off practice, you can safely extend the Ton Miles between cuts.

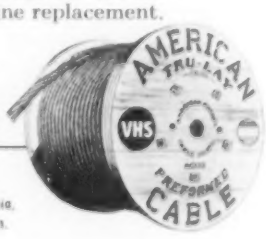
Summary: LOWER COSTS

You can save considerable money by using TRU-LAY VHS according to our recommended practices. They will increase the service life of the rope and reduce "down time" for drilling line replacement.

ASK FOR TRU-LAY VHS at your nearby Mid-Continent Supply store. For further information write to nearest American Chain & Cable Company office listed at right for **Brochure DH-489.**

ACCO American Cable Division
AMERICAN CHAIN & CABLE

Plants: Houston, Tex., Wilkes-Barre, Pa.
Offices and warehouses:
Odessa, Tex., San Francisco, Portland, Ore., Pittsburgh, Philadelphia,
New York, Los Angeles, Denver, Chicago, Atlanta · Bridgeport, Conn.



Most Modern Trucks Money Can Buy!

They're totally new . . . with a whole truck-load of advanced features that make Chevrolet, more than ever, made-to-order for your hauling tasks.

New High-Voltage Engines. Chevrolet's new Task-Force engines are all sparked by a new 12-volt electrical system. And what a difference this big extra size makes!

You'll notice it the first time you turn the key. For now you get those sure, quick, economical starts—even on the coldest days! Next you'll feel the big new wallop of action you get in every mile you go. Chevrolet's new high-voltage power goes to work the instant your foot gives the command to the throttle!

You'll agree there's nothing like it, especially when you see how much on-the-go economy there is in these new engines. For when you put High-Voltage and High-Compression together, as Chevrolet does this year, you've got the savingest engines in the stop-and-go field. And with New Overdrive* or no-shift Truck Hydra-Matic*, you'll save even more time and money.

On and on—completely new. Chevrolet even puts styling to work for you! So distinctive that it becomes a profitable advertisement-on-wheels for you and your business.

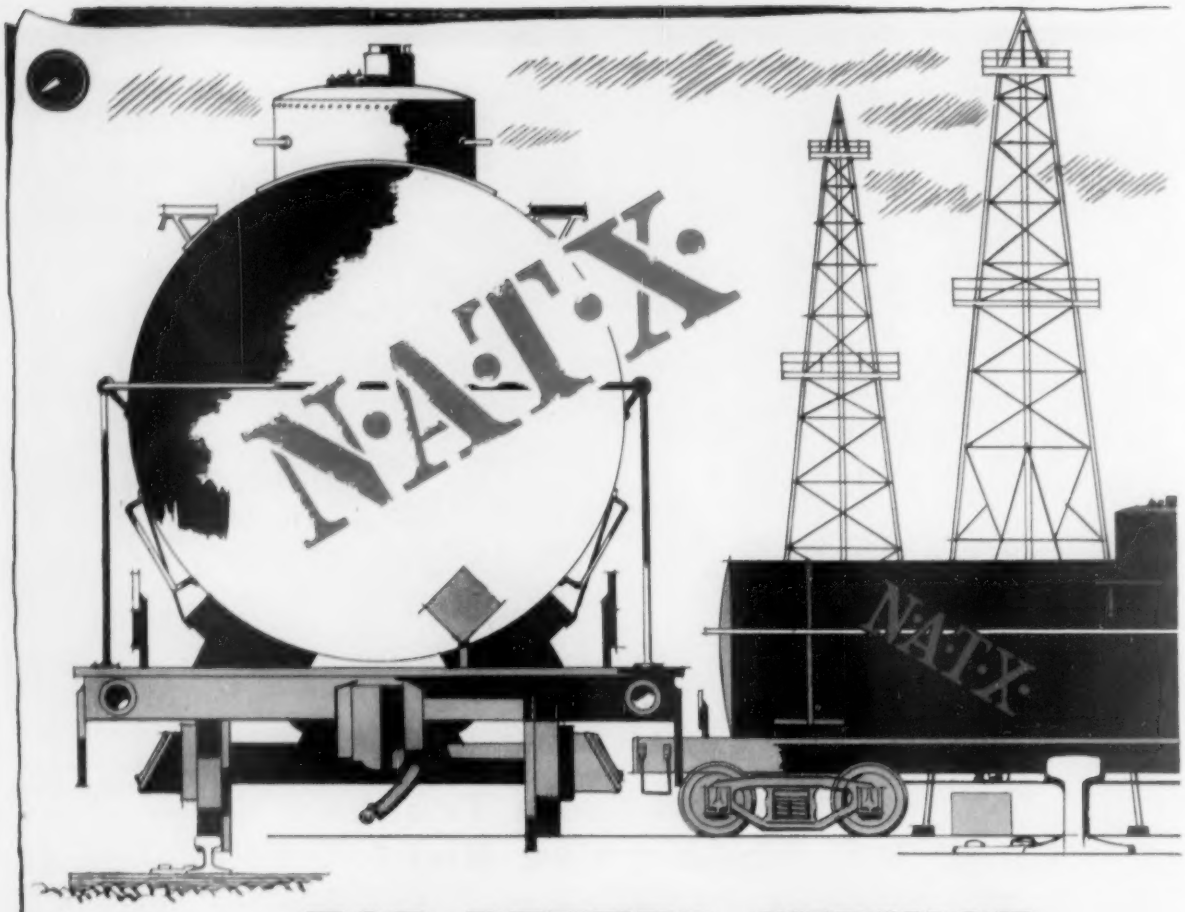
Driver and load get a far easier ride over all roads with Chevrolet's new front and rear suspension systems. A safer ride too, with the blow-out protection of Tubeless Tires on half-ton models at no extra cost.

Frames are new, more rigid, with ladder-type construction and full-length parallel side members. There's new High-Level ventilation for better air circulation in all kinds of weather; new linkage-type Power Steering* for added driving ease and safety; new Power Brakes* that stop with up to one-third less pedal pressure.

Don't stop here. The rest of the "all-new" story is equally great. So see your Chevrolet dealer. Be sure to ask about his trade-in deal too. Makes good listening for buying today. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost. Overdrive available on ½-ton models; Truck Hydra-Matic on ½-, ¾-, and 1-ton models; Power Brakes standard on 2-ton models, optional on all others. Power Steering available on all except Forward-Control models.*

NEW CHEVROLET CHEVROLET *Task-Force* TRUCKS



. . . FOR BETTER SERVICE TO PETROLEUM SHIPPERS

The top flight service you expect and *get* from North American involves not only our big fleet of specialized tank cars for petroleum products but our big store of specialized knowledge and experience with petroleum shipping problems. You'll find this combination works to your advantage every time . . . delivers *better* shipping via North American!

For Special Products Requiring Special Care

NORTH AMERICAN CAR CORPORATION

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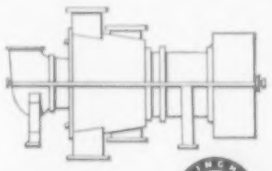
FACTS on Westinghouse 5000-hp gas turbines . . .

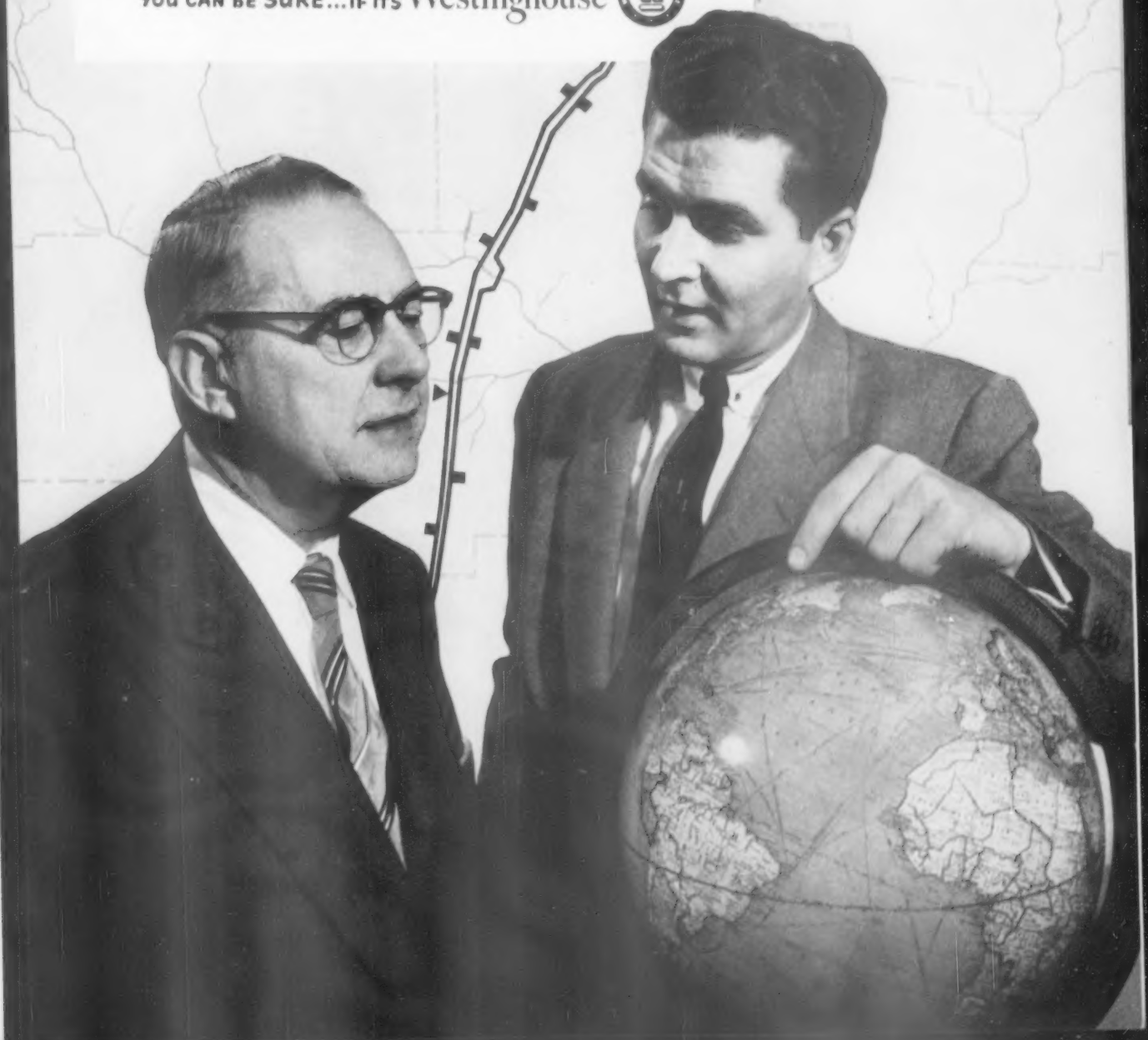
Backed by world-wide service

Wherever in the world a pipeline begins, goes or ends, there's a Westinghouse field engineer available to render competent engineering service. • This is based on 60 years' Westinghouse pipeline experience. • Field engineers are backed up by headquarters specialists who stand ready to visit locations anywhere and make detailed studies. • Every Westinghouse gas turbine carries with it this extra assurance of complete satisfaction.

For more information, see your Westinghouse sales engineer, THE MAN WITH THE FACTS, or write for booklet B-5859. Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa. J-50586



YOU CAN BE SURE... IF IT'S Westinghouse



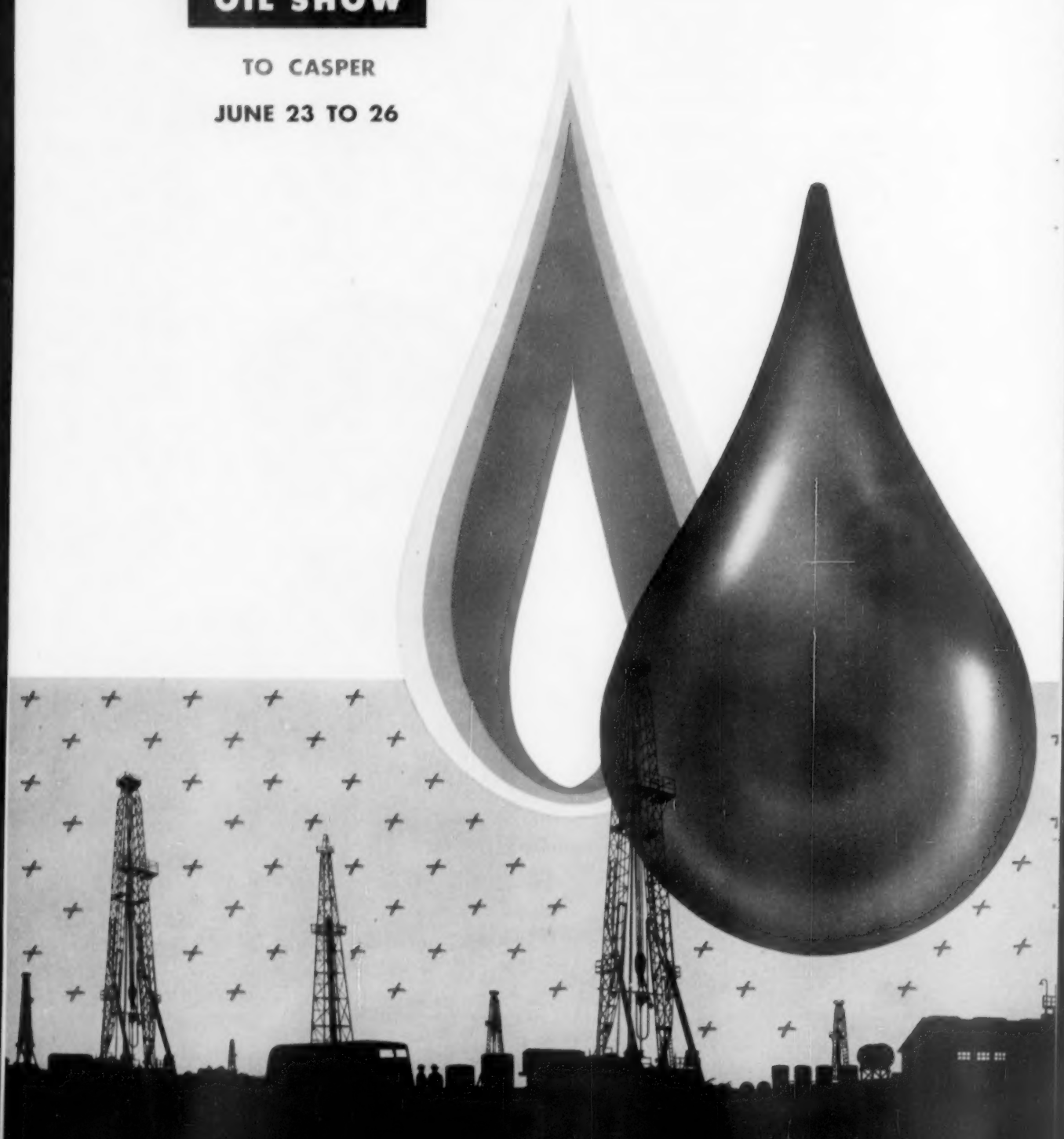
WELCOME

ROCKY MOUNTAIN OIL SHOW

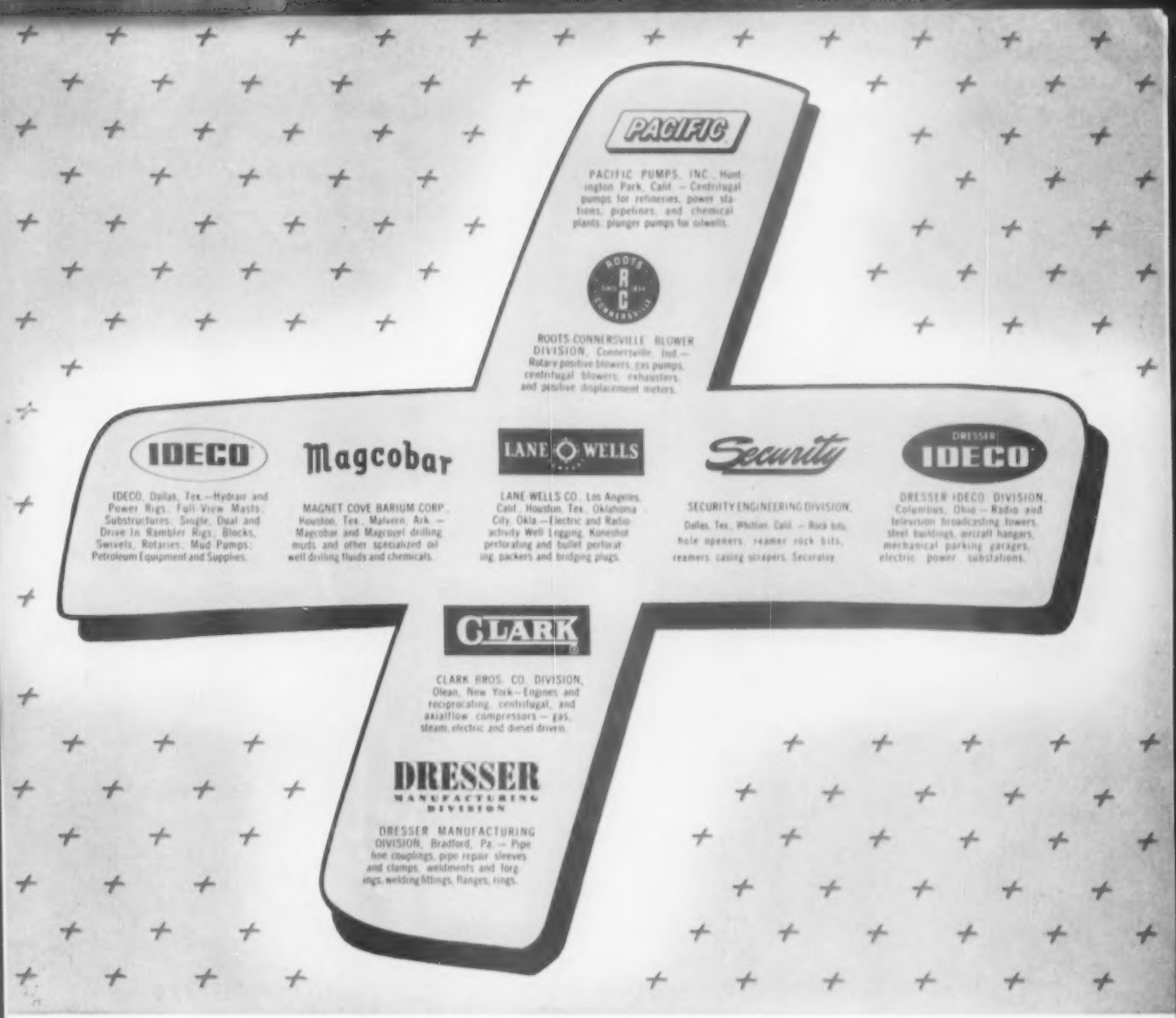
VISITORS

TO CASPER

JUNE 23 TO 26



BASIC ENERGY FOR AMERICAN PROGRESS


PACIFIC
PACIFIC PUMPS, INC., Huntington Park, Calif. — Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.
ROOTS CONNERSVILLE BLOWER DIVISION, Connersville, Ind. — Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, and positive displacement meters.
IDECO
IDECO, Dallas, Tex.—Hydrair and Power Rigs; Full-View Masts; Substructures; Single, Dual and Drive In Rambler Rigs; Blocks, Swivels, Rotaries; Mud Pumps; Petroleum Equipment and Supplies.
Magcobar
MAGNET COVE BARIUM CORP., Houston, Tex., Malvern, Ark. — Magcobar and Magcogel drilling muds and other specialized oil well drilling fluids and chemicals.
LANE WELLS
LANE-WELLS CO., Los Angeles, Calif.; Houston, Tex.; Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot perforating and bullet perforating, packers and bridging plugs.
Security
SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif. — Rock bits, hole openers, reamer rock bits, reamers, casing scrapers, Securaloy.
DRESSER IDECO
DRESSER IDECO DIVISION, Columbus, Ohio — Radio and television broadcasting towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.
CLARK
CLARK BROS. CO. DIVISION, Olean, New York—Engines and reciprocating, centrifugal, and axialflow compressors — gas, steam, electric and diesel driven.
DRESSER MANUFACTURING DIVISION
DRESSER MANUFACTURING DIVISION, Bradford, Pa. — Pipe line couplings, pipe repair sleeves and clamps, weldments and forgings, welding fittings, flanges, rings.

put the DRESSER *plus+* to work

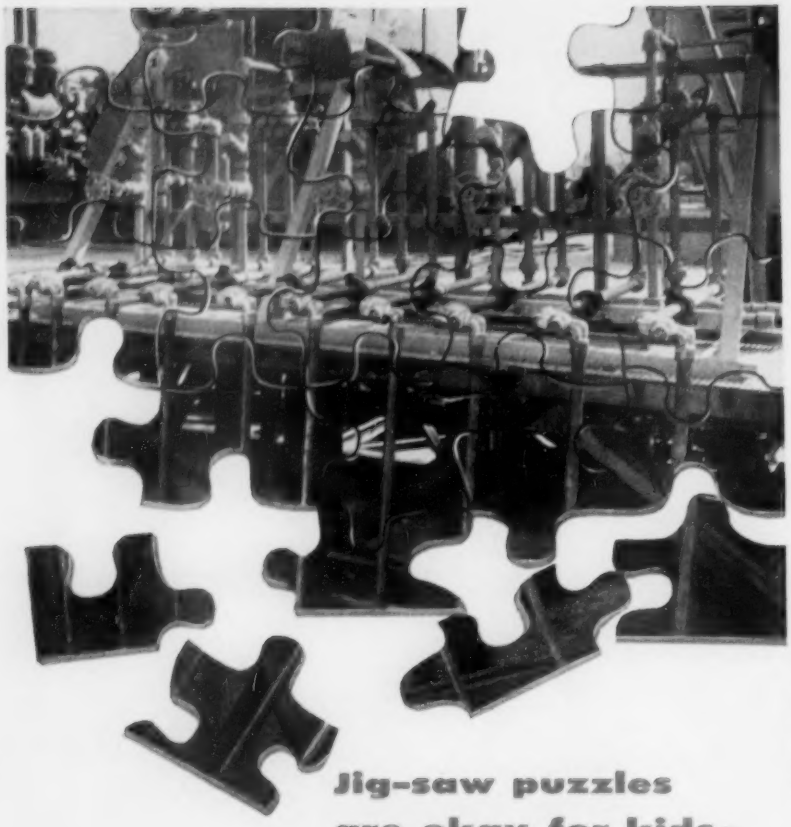
The Dresser Plus+ is the *extra* plus value you get when you are served by any one of the Dresser Industries. Operating independently to assure maximum individual attention to your specific needs, these Dresser companies work together to provide a versatile group of research, engineering and manufacturing services.

Dresser pays tribute to the many achievements of the great oil, gas and chemical industries . . . achievements that call for increasingly high standards in field and plant equipment and services. Always striving to pace these exacting demands, Dresser constantly amplifies the Dresser Plus+ wherever and whenever possible. No other single company provides the same broad range of superior products and services. Dresser equipment and services are the standard of comparison . . . the world over!

DRESSER INDUSTRIES, INC.
OIL, GAS AND CHEMICAL EQUIPMENT

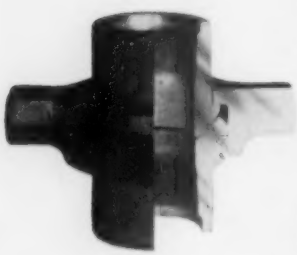
REPUBLIC NATIONAL BANK BUILDING • P. O. BOX 718 DALLAS 21, TEXAS

BASIC EQUIPMENT FOR THE OIL INDUSTRY



Jig-saw puzzles are okay for kids—

but not for a rig hook-up!



Every time you use several different make unions on the same rig you are piddling with a costly jigsaw-like puzzle.

It's a time-consuming, labor-wasting game of searching, matching, mating—and hoping—the different unions will fit.

In today's highly competitive oil business time wasted is money lost. That's why thousands of oil men are finding **it is wise to standardize with WECO Unions.**

By standardizing with WECO Unions you save time, reduce costs, minimize errors, avoid misfit and makeshift connections. Because with WECO you always get the exact size, type and pressure union you need for every oilfield service.

PESA

US-55

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"In the case of fuel oil, it is the burner manufacturers and dealers—many of whom are also oil marketers, I must say—who have built the market we have. . . . By and large, the oil industry has not carried its share of the load. . . ."

Marc. F. Braeckel, vice president, Sinclair Refining Co.

"It Doesn't Make Sense"

"The Government has sold rubber plants and disposed of other business competing with private enterprise. It simply doesn't make sense now to proceed with this headlong plunge into the atomic-energy industry at an expenditure of public funds which dwarfs any other business activity ever undertaken by the federal Government. . . ."

Tom Pickett, executive vice president, National Coal Association, in an address in Chicago before the National Fuel Credit Association.

Being Specific

Dear Sir:

This is in reference to the definitions of "Density" and "Specific Gravity" given on page 134, May 23 issue.

The Oil and Gas Journal is really an international magazine and as a reader of it I feel it is my obligation to go over the definitions forementioned.

In European textbooks, we find the following definitions (also taught that way in our universities):

. . . **Absolute density** of a homogeneous substance at a known temperature is the amount of mass (pound-mass or gram-mass) the substance has by unit volume.

. . . **Relative density** of a substance is the ratio of its density to that of the water at the same or any other temperature.

. . . **Absolute specific gravity** and rela-

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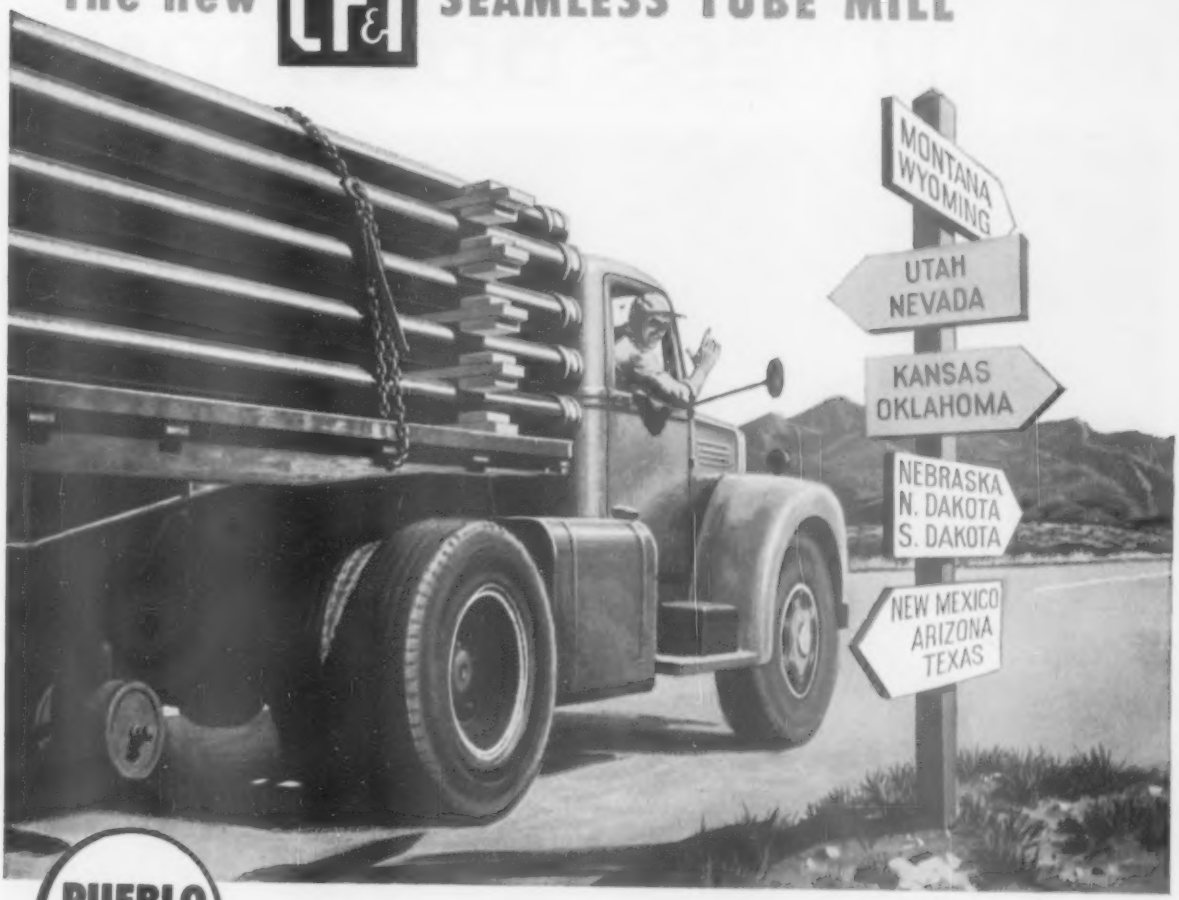

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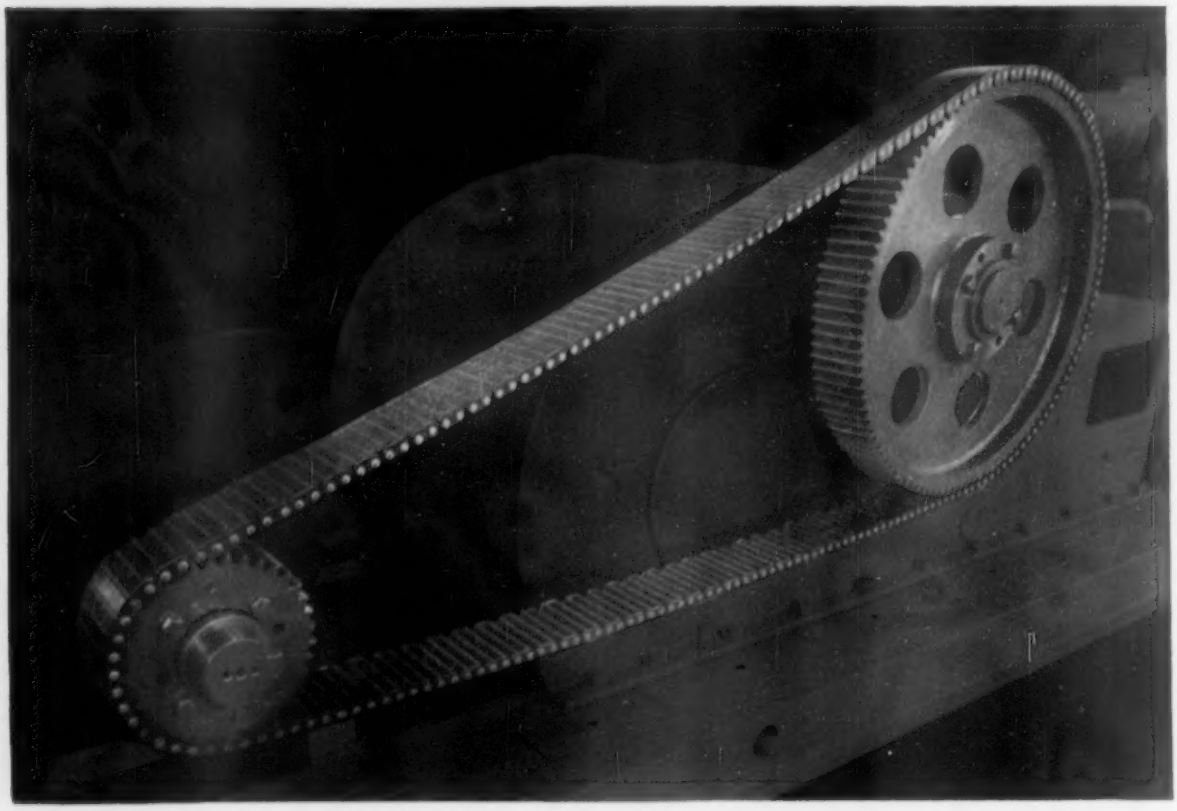

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tive specific gravity are defined in the same manner, but using weight (pound-force or gram-force) instead of mass.

The relation between one another is as follows:

$$\text{D (abs.)} = \frac{M}{V};\ \text{D (rel.)} = \frac{\text{D (body)}}{\text{D (water)}}$$

$$= \frac{\text{M (body)}/V}{\text{M (water)}/V} = \frac{\text{M (body)}}{\text{M (water)}}$$

$$\text{Sp. G. (abs.)} = \frac{F}{V};\ \text{Sp. G. (rel.)}$$

$$= \frac{\text{Sp G. (body)}}{\text{Sp. G. (water)}} = \frac{\text{F (body)}/V}{\text{F (water)}/V}$$

$$= \frac{\text{F (body)}}{\text{F (water)}}$$

FORCE, F = M, mass, times acceleration. Therefore:

$$\text{Sp. G. (rel.)} = \frac{\text{M (body)}}{\text{M (water)}} \text{ and}$$

$$\text{Sp. G. (rel.)} \times \text{M (water)} = \text{M (body)}$$

Therefore, in English - American books, specific gravity usually, but not always, means "relative specific gravity" or "relative density," and density usually means "absolute density."

I hope the above may be useful to you and to the readers, especially those abroad.

Thomas Garcia B.
Chief Chemist
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". . . **Growth in sales** in favorable profit areas.

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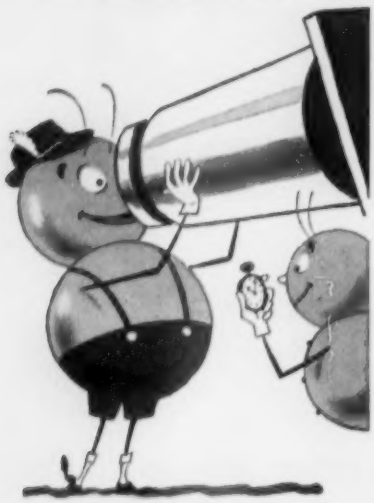

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barrels of crude and products through already busy pipelines; and training and aiding dealers to sell more gallons through already existing service stations. . . ."

P. C. Spencer, president, Sinclair Oil Corp., in an address at the annual meeting of stockholders.

CALENDER

JUNE

23-24 Western Petroleum Refiners Association, technical-industrial relations meeting, Broadview Hotel, Wichita, Kans.

23-26 Rocky Mountain Oil Show, Casper, Wyo.

26-July 1 American Society for Testing Materials, Chalfonte-Hadden Hall, Atlantic City, N. J.

30-July 1 Research conference, "Flow of Natural Gas From Reservoirs," University of Michigan, Ann Harbor.

JULY

20-22 Instituto Tecnologico y de Estudios Superiores de Monterrey, first annual short course on instrumentation for industry, campus, Monterrey, N. L., Mexico.

AUGUST

15-16 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

15-17 Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Ore.

29-31 15th annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

26-Sept. 15 Graduate summer session in reservoir engineering, University of Texas, Austin.

SEPTEMBER

11-13 Independent Natural Gas Association of America, annual meeting, Jasper Park Lodge, Jasper Park, Jasper, Alberta, Canada.

12-14 American Institute of Electrical Engineers, electrical conference of the petroleum industry, Shamrock Hotel, Houston.

12-16 Tenth National Instrument Conference and Exhibit, Los Angeles, Calif.

12-16 Second International Instrument Congress and Exposition and tenth National Instrument Conference and Exhibit, Shrine Auditorium, Los Angeles.

14-16 National Petroleum Association, 53rd annual meeting, Traymore Hotel, Atlantic City, N. J.

14-17 American Association of Petroleum Geologists, western Canada regional meeting and fifth annual field conference of Alberta Society of Petroleum Geologists, Jasper, Alberta, Canada.

22-23 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

22-23 Louisiana-Arkansas Division, Mid-Continent Oil and Gas Association annual membership meeting, Roosevelt Hotel, New Orleans.

26-28 American Association of Oilwell Drilling Contractors, fifteenth annual meeting, Rice Hotel, Houston.

26-28 American Institute of Chemical Engineers, fall national meeting, Lake Placid Club, Lake Placid, N. Y.

29 Natural Gasoline Association of

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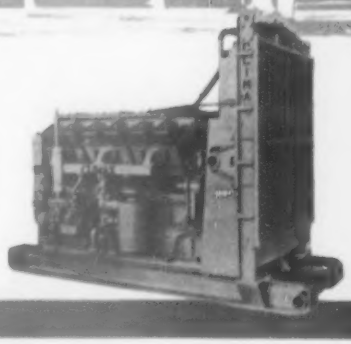

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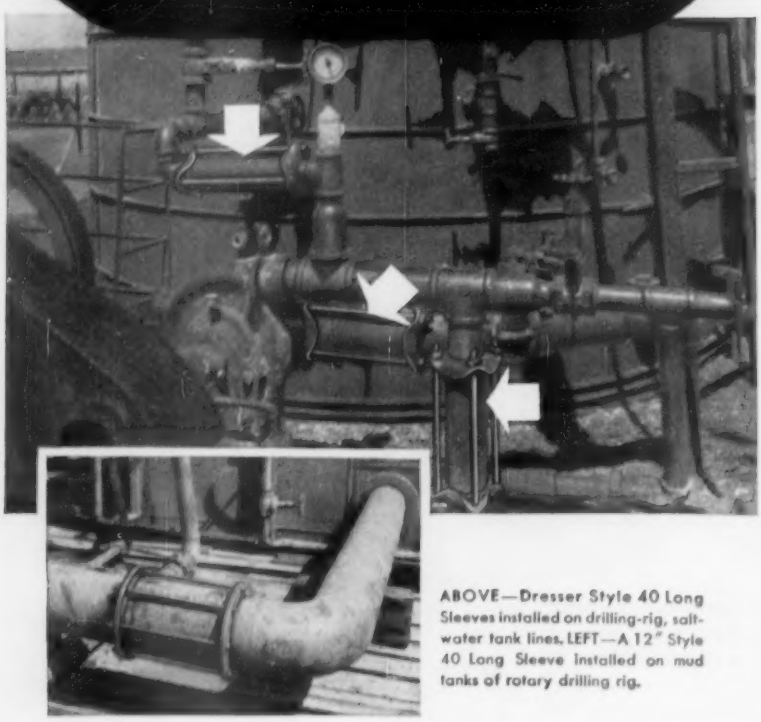

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America, Oklahoma regional meeting, Skirvin Hotel, Oklahoma City.

OCTOBER

2-5 American Institute of Mining and Metallurgical Engineers, Petroleum Branch, fall meeting, Roosevelt Hotel, New Orleans.

2-6 American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D. C.

3-4 Texas Mid-Continent Oil and Gas Association, 36th annual meeting, Baker Hotel, Dallas.

3-6 Rocky Mountain Association of Petroleum Geologists and Denver Geophysical Society, 25th annual meeting, Denver.

9-15 American Petroleum Institute, Oil Progress Week.

12-14 National Association of Corrosion Engineers, sixth biennial Permian basin tour, Lincoln Hotel, Odessa, Tex.

12-14 Gulf Coast Association of Geological Societies, annual meeting, Buena Vista Hotel, Biloxi, Miss.

12-14 Gas Appliance Manufacturers Association, El Mirador, Palm Springs, Calif.

13-14 California Natural Gasoline Association, annual fall meeting, Ambassador Hotel, Los Angeles.

14 American Institute of Chemical Engineers, South Texas Section, 10th annual technical meeting, Galvez Hotel, Galveston, Tex.

17-19 American Gas Association and Pacific Coast Gas Association, annual meeting, Ambassador, Biltmore, and Statler Hotels, Los Angeles.

18-22 National Safety Council, 43rd National Safety Congress and Exposition, Chicago.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Garrett Hotel, El Dorado, Ark.

24-27 National Association of Railroad and Utilities Commissioners, natural gas panel discussion, Asheville, N. C.

27-29 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

28 Natural Gasoline Association of America, southern regional meeting, Captain Shreve Hotel, Shreveport.

31-Nov. 1 Independent Petroleum Association of America, annual meeting, Jefferson Hotel, St. Louis.

31-Nov. 2 National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER

2-4 American Association of Petroleum Geologists, Mid-Continent regional meeting, Skirvin Tower, Oklahoma City.

2-4 Society of Automotive Engineers, diesel engine meeting, Chase Hotel, St. Louis.

9-10 Society of Automotive Engineers, fuels and lubricants meeting, Bellevue-Stratford Hotel, Philadelphia.

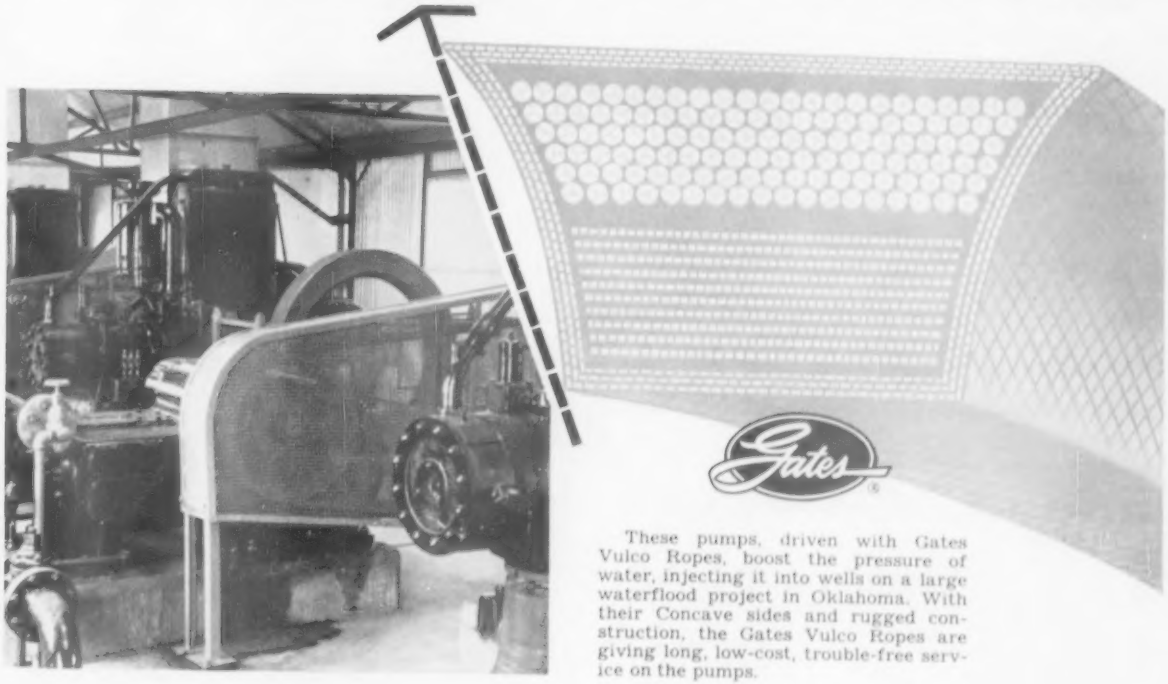
10-11 American Association of Petroleum Geologists, Pacific Section annual convention, Biltmore Hotel, Los Angeles.

13-18 American Society of Mechanical Engineers, 75th anniversary meeting, Hilton and Blackstone Hotels, Chicago.

14-17 American Petroleum Institute, 35th annual meeting, Mark Hopkins, Fairmont, St. Francis and Palace Hotels, San Francisco.

27-30 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit.

"Secret" of *lower* belt costs is concave sides



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Here's WHY concave sides keep belt costs down:

When the Gates belt is bent around the sheave, the *precisely engineered* concave sides (Fig. 1) fill out and become straight (Fig. 1-A). Thus the belt makes uniform contact with the sides of the pulley.

This full, uniform contact assures *even distribution of wear.* Naturally, *even wear* means *longer wear.* And longer wear cuts belt replacement costs...reduces down time...contributes to profits.

Prove to yourself the value of concave sides

Bend a straight-sided belt (Fig. 2) and feel the sides *bulge out* around the bend. You see immediately that the bulging sides prevent an even fit in the pulley groove (Fig. 2-A). Uneven contact causes faster wear...increases belt replacement costs.

Reduce costs and down time for belt replacements—specify Gates Vulco Rope Drives—the V-Belt with *concave sides* (U.S. Patent 1813698). The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING...

Secret of Success

BACKHANDED praise for the type of job done by our favorite oil publication is contained in a recent report by the Organization for European Economic Cooperation on the production capacity of oil equipment in Europe.

This outfit inquired into the reasons why American oil equipment is preferred by operators practically all over the world, and why European manufacturers can't seem to make much of a dent in this market.

As reported by a British newspaper, the conclusions included the following:

"Far wider publicity could be given to technical information and much more exchange of experience could take place than at present, believes the report.

"In the U. S., where a large number of press articles give extremely wide publicity to information of interest to all manufacturers, it has been proved, says the report, that this exchange of information is not necessarily incompatible with the existence of manufacturing secrets.

"The report also recommends closer contact between manufacturers and oil companies."

So, you see, the Europeans give credit to business magazines like the Big Yellow Book for America's technological progress and superiority. We could add that the existence of enterprising reporting and publishing, from the early days of this country's industrial history, has been a big factor in whetting Yankee ingenuity and in creating a general atmosphere of free exchange of information, technical and otherwise.

Frequently the editors of foreign business publications wistfully voice envy of the ease of obtaining trade information that exists in the United States. But this condition didn't just happen.

We in the publishing business, and our predecessors, had to create the enviable condition by aggressive, on-the-spot reporting—often at the cost of the wrath of operators who didn't want their methods and equipment disclosed to competitors. Today, free exchange of technical information is the rule rather than the exception in this country, and we are glad to see that Europeans now acknowledge this achievement of the business press.

But we have to keep working at it. A good many lights are still hidden under bushels, and it takes everlasting, aggressive reporting to make them shine for the whole industry. That's our job here on the Journal, and it's fun as well as a contribution to national progress.

And as for the European recommendation for "closer contact between manufacturers and oil companies," what better means could there be than the advertising pages of the Oil Man's Bible?

Visual Aid

COUPLE of months ago, in our exploration issue, we included an insert wall chart which we titled the Journal's Oil and Gas Field Classifier and which illustrated various types of oil formations.

There's been quite a demand for extra copies, and one oil man back East, where there's not much oil production, got half a dozen. He now writes:

"We have one on the company bulletin board, I have one at my finger tip, each of my children took one to school and the teacher tried to interpret the meanings to the classes. From this you can see your classifiers are being well used and much appreciated."

We like that fine—all except that line "the teacher tried to interpret." That makes it sound like something pretty long-haired and unintelligible. Actually it's pretty simple to an oil man, and perhaps even kindergarten stuff to a geologist.

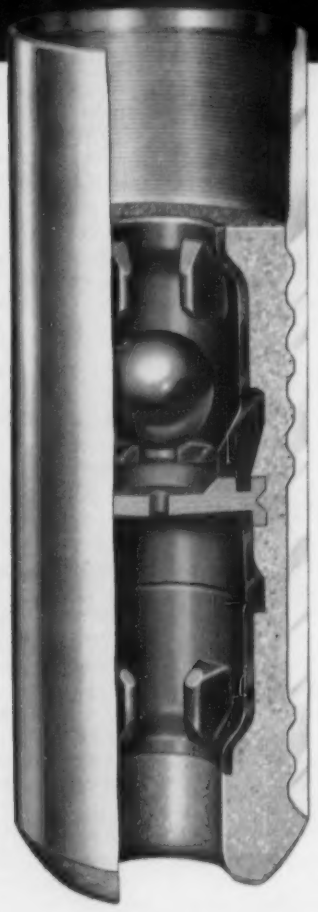
But come to think about it, for grade-school kids a teacher probably would have to translate such terms as bioherm into coral reef, and graben into long, flat valley. But with a little interpretation of this sort, plus a very general background in geology, any teacher ought to be able to use one of our classifiers as means of expanding her charges' knowledge of the world on which we live and in which we try to find oil.

Of course we printed the classifier to help oil men understand their exploration and producing problems, and it's a mighty useful thing for any operator to have handy. But if it also helps the upcoming generation to understand some of the problems of the oil industry, we're glad to be of service.

—Henry D. Ralph.

AUTOMATIC, REGULATED FILL OF THE CASING AS IT IS BEING RUN

***PROTECTION AGAINST DESTRUCTIVE HIGH-PRESSURE SURGES**



with

BAKER FLEXIFLOW

FILL-UP SHOES AND COLLARS

Baker Flexiflow Fill-Up Equipment, a new companion line to Baker Differential Fill-Up Equipment is designed to be run in wells of moderate depth.

FEATURES

SELF-ADJUSTING FLOW CONTROL DIAPHRAGM

Baker Flexiflow Fill-Up Equipment contains a variable valve (Self-Adjusting Flow Control Diaphragm) that automatically opens wider or closes down to provide MINIMUM BOTTOM-HOLE PRESSURE INCREASES and regulated fill of the casing.

POSITIVE BALL-TYPE BACK-PRESSURE VALVE FOR CEMENTING

A Ball-Type, Back-Pressure Valve for floating or cementing can be brought into action at any time by applying a pressure of approximately 700 psi to the casing. See Figs. 2 and 3 below.

COMPLETELY DRILLABLE

The internal parts of Flexiflow Fill-Up Shoes and Collars consist of readily drillable concrete, a small amount of Bakelite and synthetic rubber.

ECONOMICAL

Baker Flexiflow Fill-Up Equipment not only permits the casing to be run more rapidly with greatly reduced pressure increases or surges on the formations below the shoe, but in addition, by eliminating the surface-filling operation, saves an additional amount of rig time. When these advantages are considered, Flexiflow Equipment is much more economical to run than conventional floating equipment.

*Pressure surges over 5,000 psi can be created each time a joint of casing equipped with conventional floating equipment is lowered under certain slim hole clearances.

High-Pressure surges can fracture and weaken a formation sufficiently to cause lost circulation or the failure of a primary cement job.

These destructive, high-pressure surges can be reduced . . .

- by increasing the lowering time per joint
- by increasing the casing clearance

or

- by running Baker Flexiflow (or Differential) Fill-Up Shoes and Collars

NOTE:

Baker Fill-Up Equipment contains a variable valve that automatically opens up and adjusts to maintain minimum bottom-hole pressure as the casing is being run.

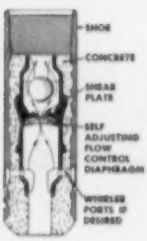


FIG. 1 Casing Filling while going in the hole

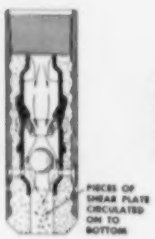


FIG. 2 Ball pumped through diaphragm

FIG. 3 Ball shut-off against cement back-pressure

BAKER
OIL TOOLS, INC.
HOUSTON · LOS ANGELES · NEW YORK

How to go broke producing oil

IN two widely separated fields on this continent, oil operators have just learned a costly lesson on how to go broke drilling producing wells. Rather, we should say, they can see an object lesson, because it is doubtful that many are really converted.

To some a successful well may be one that produces some oil. But by the balance sheet, or by common sense, a well isn't successful unless it pays back its cost plus something more.

The two most spectacular current examples of this are Spraberry in West Texas and Huntington Beach in California. In both fields a majority of the wells will be financial failures. The two fields are much different in every respect save one: The spacing was too close.

HOW CLOSE IS TOO CLOSE? In the Jones pool of Huntington Beach ("Bedlam Beach"), the more than 200 wells on an 85-acre tract would seem rather close spacing even to a layman, and engineers say that 15 or 16 wells would adequately drain the whole pool.

In Spraberry, the 2,400 wells scattered over 400,000 acres might seem widely spaced. Here the minimum spacing was 40 acres, but engineers say most 160-acre tracts would yield as much oil with one well. So probably the same amount of oil could be produced with one-fourth the wells at one-fourth the cost.

Many fields doubtless need denser drilling than one well to 40 acres. Some favored few possibly could support 200 wells on 85 acres and give a handsome payout to all. No two oil reservoirs are the same.

The only way to determine the best well spacing is to hold up development drilling after the first few wells until the reservoir's size, yield, and payout are studied. Then start with quite wide spacing and turn to infill drilling later on if it is economical. The way to do this is to pool surface interests within a single drilling unit, whatever its size.

LET'S ASSUME that ultimate recovery from Spraberry and Huntington Beach will be the same regardless of the number of wells, so we can disregard the public interest in conservation. Then the only factor to consider is the operators' payout.

State regulatory authorities ought to protect producers from their own folly in drilling too close too soon by requiring pooling of interests within spacing units and setting wide spacing during early development of a field.

In addition to conserving present oil, these bodies have a responsibility to prevent waste of economic resources that impairs the industry's financial ability to find new oil for the future.

Those Not-So-Small Details

Standard Oil Co. (N. J.) Photo

● Placing the measuring line over the sheave is one of the small details that mean a lot in a safe, successful cementing job. There are many parallels in producing cements to meet the wide range of conditions encountered in the oil fields today.

One of these is the ritual of cleaning and checking laboratory apparatus before each test. Every detail counts, in controlling quality to assure dependable performance, even under the highest pressures and temperatures in deep, hot wells—and in assuring resistance to sulphate action, to protect the casing against corrosion.

Careful attention to all the not-so-small details is the Oil Man's assurance of the properties needed for a first-class cementing job.

LONE STAR CEMENT CORPORATION

Offices: DALLAS • HOUSTON • ABILENE, TEX. • NEW ORLEANS • BIRMINGHAM
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Select Cement to Fit the Job!

THIS WEEK . . . . . IN THE NEWS

Labor

• Sinclair's new contract with the CIO Oil, Chemical and Atomic Workers International Union will get close study from both management and union leaders in other companies. It may set a pattern. Union officials claim the contract gives Sinclair workers the best sickness and accident benefits in the industry plus improved job security. This takes the form of new protection against contracting out work and transfer machinery in event of layoffs. These benefits were received in addition to a 10-cent hourly wage increase.

International

• Tax concessions for marine drilling may soon be granted by Trinidad. Favorable action on concessions was indicated after three British companies told the government they were halting plans for further development until the depletion allowance issue was decided.

• Prospects for gas production in Israel are improved. Israel-American Oil reports the most important gas strike in the country to date.

• National Iranian Oil faces a continuing dilemma: whether to sell its 12½ per cent oil share to the consortium and risk domestic political agitation, or take a loss on the open market to gain permanent outlets.

Natural Gas

• The question of the FPC's jurisdiction over the wellhead sales of natural gas will probably be debated again soon before the commission. The new airing will result from a ruling by an FPC examiner that the commission does not have power to regulate sales under the Phillips case.

• A congressional committee may look into gas transmission and distribution charges. Arkansas' Rep. Oren Harris says the probe will show the producer is not to blame for high gas prices.

Production

• An unusual leasing deal in New Brunswick apparently has paid off for Orville H. Parker, Ponca City, Okla., independent. He was promised half interest in a 10,000-sq.-mile lease if he could boost production in the field to 3,600 bbl. monthly. His first well, drilled between two marginal wells in an ancient field, came in for an estimated 100 bbl. daily—nearly enough to meet leasing conditions.

• Operators in the Cogdell field of West Texas now have the green light to proceed with a big unitization and pressure-maintenance project. The project is expected to recover 60 million barrels of additional oil from the Canyon Reef pay.

• Expect crude-oil production to reach a peak of about three billion barrels per year in the United States in 1965 and then begin a slow decline. Looking ahead 20 years, Eugene Ayres, Gulf Research Co. consultant, gives this oil picture: Imports will become more important by 1975, domestic oil will cost more to find and produce, natural gas will be in short supply, and shale oil will have high value.

• Some of Imperial's production in southern Saskatchewan may soon be flowing south across the international border to Great Northern's refinery at St. Paul. Imperial is reported making a deal to sell the production to Shell, which will then sell it to Great Northern.

Refining

• Asphalt appears well on its way to a record year in production and sales—and 1955 may only be the start of a big upsurge in demand. First-quarter demand increased 19 per cent, and the upward trend is expected to continue for at least a decade. The reasons: more road-building and other normal uses, plus new potential applications.

• Refiners have another fuel problem to solve because of new supersonic jet-engine requirements. High thermal stability is now necessary to prevent formation of sediments which clog fuel systems.

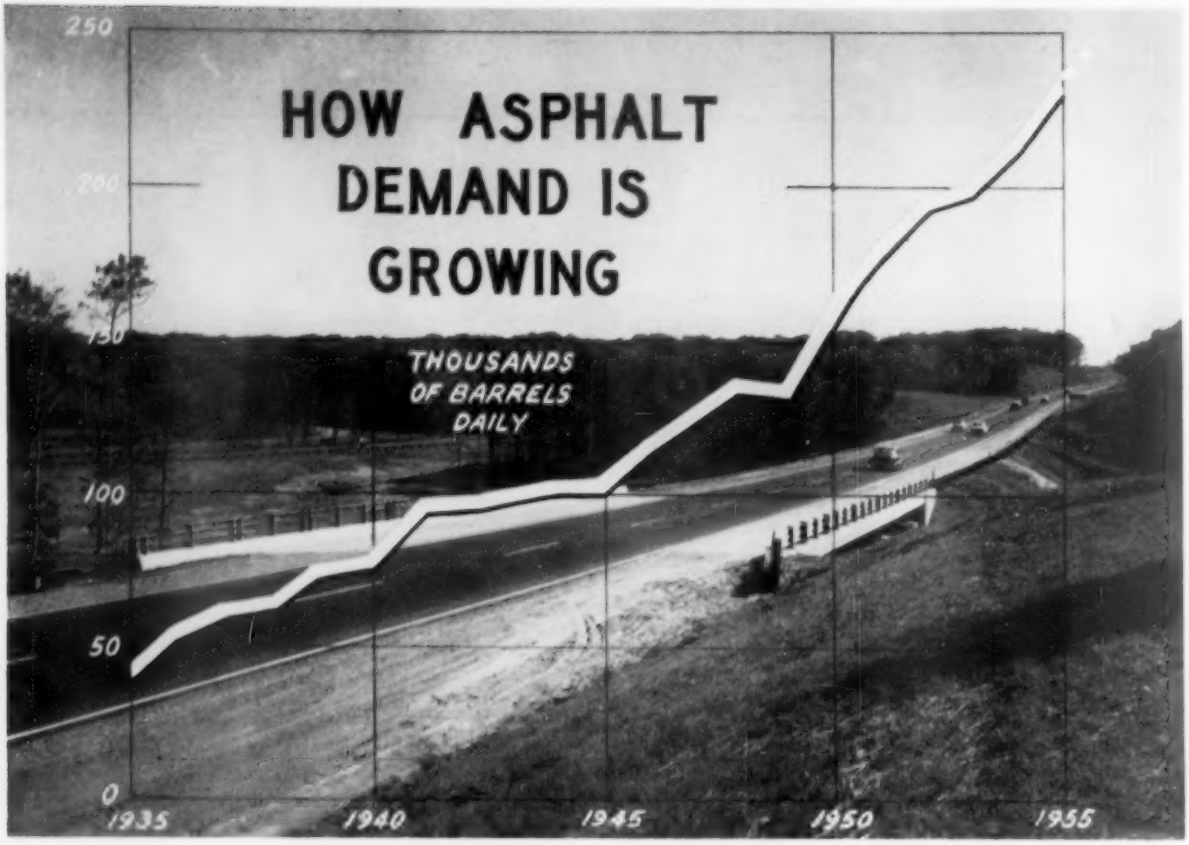
Pipelining

• El Paso Natural Gas Co. has put an $185 million cost tag on its proposed big-inch looping program from the San Juan basin to the West Coast. Its proposal is now before the Federal Power Commission for approval.

• Plans to send Williston basin crude through a new pipeline to Canada are a step nearer reality. The Canadian House of Commons railway committee has recommended incorporation of Stanmount Pipe Line Co., which proposes to build the line.

Exploration

• Montana has what may be the year's most important discovery in the Rockies. Atlantic Refining is coring ahead after recovering 6,100 ft. of foamy oil in a drill-stem test of the Amsden dolomite at 6,108-25 ft. The well, 1 Horton estate, is 24 miles south of the nearest Amsden production in Northwest Sumatra field.



Asphalt Headed for All-Time Records

- Demand during 1955 expected to reach new high, yet it may be only the threshold of an upsurge in the market
- Highway programs will soak up most of the output, but "miscellaneous" users loom as big potential consumers

George Weber

ALL records for producing and selling asphalt are due to be broken this year. And 1955 is considered only the beginning. Several indications point to a strengthening of the asphalt market for the next decade at least.

It is likely that demand for asphalt will outstrip other petroleum products percentagewise in view of growing needs for conventional applications, plus new potential uses now entering the picture.

Some indication of this year's market can be seen from first-quarter figures. Demand rose to 116,700 bbl. per day, a 19 per cent rise over the first quarter of 1954. This is a sharp jump for a period when road maintenance and building programs are barely under way. It points to a substantial new record for 1955 demand, which may prove to average close to 240,000 bbl. per day.

While 1955 looks like a big year for asphalt, it's believed to be only the threshold of a new surge in demand. Predominant in the news today is the national program for road building. The extent to which this will consume added production is not yet known, pending congressional action. But a firm increase in demand for paving uses is definitely in the picture.

The current level of building—which is 15 per cent above last year—further bolsters the market for asphalt going into roofing and other building materials. The trend for this market is less predictable, but it is expected to contribute to an over-all rise. In the category of miscellaneous uses are a number of potential demands which may well represent sizable fractions of total production the next few years.

Paving uses . . . The paving demands for asphalt are rising fast, well in advance of the organized road-building program now under consideration. In 1953, 65.3 per cent of all asphalt went into the surfacing of highways, airports, parking areas, driveways, and numerous similar uses.

Although complete figures are not yet available, it appears that about 70 per cent of all asphalt marketed in 1954 went into paving uses. This represents about 53.5 million barrels or 9.8 million tons. Including over 7 million barrels of road oil, the total paving program last year amounted to more than 60 million barrels.

Last year's paving demand was split about evenly between highway maintenance and new road construction.

The highway maintenance figure alone represents a firm year-to-year outlet for asphalt and road oil. During the next 10 years, it may be expected to amount to 30 million barrels per year at the very least. More likely, it will be increased in view of the rapid

deterioration of many thousands of miles of highway and roads.

Normally roads and highways come up for resurfacing every 12 to 13 years. But the effect of inattention during World War II, plus the rapid rise in traffic, have combined to set back road maintenance severely. Consequently, the asphalt earmarked solely for maintenance should rise above the 30 million mark for the next several years.

Most of the asphalt not used in maintenance went into new construction. It amounted to an estimated 30 million barrels or 5.45 million tons. This compares with the 5.25 tons of bituminous materials the American Road Builders Association estimates as current normal yearly usage. The Road Builders arrived at their figure during a study for the Clay committee (the advisory committee on a national highway program).

A NEW CONCEPT in designing road foundations is the buried-membrane method. As shown here, the right-of-way is excavated and an asphalt coating laid down. The foundation, which can consist of local soil, is then backfilled and the foundation materials stabilized and coated with asphalt. This provides an envelope which prevents water seepage into the highway foundation.

Future paving demands . . . The question now is what increment above this "normal" demand of 5¼ to 5½ million tons of asphalt will be added in the proposed national road-building program. No one knows. But some indications of the increased demand may be gained from watching Washington.

When the "Grand Plan" for highway construction was first aired late last year, the recommendation for a $101-billion, 10-year program indicated a very substantial rise in asphalt for new highway construction. This plan, based on recommendations by the Clay committee, called for the following in over-all expenditures and asphalt requirements:

Year—	Expenditures $ billions	Asphalt millions of bbl.
First	6	40
Second	8	51
Third	10	62
Fourth through tenth	11	67

This program alone would have doubled the asphalt demand for new highway construction. It would have boosted total demand 45 per cent by the fourth year of the program and this demand would have continued for 6 years.

Coupled with maintenance requirements and additional needs for roofing and miscellaneous needs it might have raised annual asphalt requirements to 125,000,000 bbl. per year by 1961.

But from all appearances, this bold approach will not be taken, at least not for a few years.

Legislation . . . Two major highway bills are now pending in Congress. Senate bill 1048, sponsored by Senator Gore of Tennessee, has passed the Senate and is now awaiting action by the House. Senate bill 1160, sponsored by Senator Martin of Pennsylvania and called the administration bill, carries out the Clay committee recommendations.

While it is fruitless to guess what legislation will be enacted, it appears appropriations may conform closely to those outlined in the Gore bill.

Covering only 5 years, the Gore bill calls for a $12.25-billion federal expenditure. This compares with a current federal expenditure of roughly $1 billion yearly. Under the Gore bill expenditures would total $1.9 billion the first year beginning July 1, 1956, $2.15 billion the second, $2.4 billion the third, and $2.9 billion the fourth and fifth years. This would amount to an over-all increase in asphalt demand of about 50 per cent for new highway construction.

If the Gore bill figures are combined with proposed allocations from states and miscellaneous federal funds, you come up with a total expenditure of $17.941 billion for the 5-year period. States would be called on to provide $5.361 billion and miscellaneous federal funds would amount to about $330 million.

Allocations of the state-federal total would rise from $2.977 billion the first year to $4.088 for the fourth and fifth years.

Rehabilitation needs . . . No firm figures are available on the mileage of highways and roads in need of widening and general rehabilitation. A large fraction of the national program will undoubtedly be directed to this type of work. In this field, the overlaying of concrete pavements with asphalt has proved the most practical method. Even those states which are most concrete-minded have adopted this practice.

A large potential asphalt requirement is seen in this resurfacing program. Assuming an average pavement width of 24 ft. and a 3-in. overlay of asphalt mix, requirements would amount to about 300 bbl. of straight asphalt per mile.

Soil stabilization . . . In some parts of the country, the supply of high-grade aggregate for road building is becoming depleted, and state highway departments are turning to soil stabilization in building roadbeds. This new technique is being practiced in Kansas, California, and on an experimental basis in Washington.

Research has found that cracked asphalt fractions can be used to advantage for this type of work since they show superior coating characteristics for soil and dusty aggregates. As the reserves of prime aggregate dwindle in other sections of the country, refiners may find a growing market for asphalts, and particularly heavy cracked fractions for soil stabilization.

Roofing demand . . . Asphalt requirements for roofing materials last year took approximately 20 per cent of total production. This represented a slight decline from the 1953 usage, which reached nearly 3.5 million tons. But roofing asphalt should see better demand this year in view of the high level of new building. Its percentage of total demand, however, may not rise. The gradual curve in roofing demand, from 2.8 million tons in 1950 to the estimated 3.5 to 4.0 million tons this year, will probably continue at routhly the same percentage increase yearly.

Other and potential uses . . . The "mis-

ASPHALT'S ACCEPTANCE by road builders is indicated by its record in recent turnpike construction. Of the 1,346 miles of turnpikes contracted last year, 1,091 miles were for asphalt. This preference is based not only on lower initial costs as compared with portland cement, but also on greater maintenance economics and better service. This photo is of New Jersey's Garden State Parkway (Photo by Ostergaard).

cellaneous" uses of asphalt are the ones to watch.

Major end uses in this category have been for waterproofing, blending with rubber, pipe coatings, molding compounds, briquetting of coal and coke, paints, enamels, and lacquers. Much private research is going forward on specialty asphalt products to meet these and other needs. Refiners are finding that customers are becoming more and more rigid on specifications for paving, roofing, and other uses.

There are two major potential uses which have seen little or no oil-company promotion. Probably the largest of these tonnagewise is in railroading. The other involves hydraulic uses such as in water conservation, irrigation, and beach errosion.

The stabilization of ballast by spraying railroad beds with hot asphalt has proven highly economical in test cases begun in 1943, yet very little has been done to expand this new outlet. Savings in maintenance costs have amounted to $1,300 per year per mile of track. Tie replacement has averaged 47 per year in asphalt treated mileage, as compared with 117 per year on untreated right-of-way.

Conclusions of studies conducted by Illinois Central Railroad in cooperation with the Asphalt Institute, The Texas Co. and others were that such applications are practical and beneficial. The coating can be laid down by a distributor mounted on a flat car and fed from a tank car in a regular work train. A gondola with a stone spreader follows to apply a top coating over the asphalt. The operation can proceed at a speed of 3 to 5 miles per hour.

Approximately 2.4 gallons per square yard of 85 to 100 penetration asphalt is applied. This amounts to about 400 bbl. per mile. If this practice were adopted by the Class I railroads alone, it would require roughly 100,000,000 bbl. of asphalt. The treatment is expected to last for about 7 years. Assuming Class I railroad adoption of such a program, it would amount to an annual demand for 14,000,000 bbl. per year, or 18 per cent of total current production.

The Asphalt Institute has been cooperating in this program for several years, and is considering a research project which will determine the best grades of asphalt to use. A concerted effort on the part of asphalt manufacturers could undoubtedly create an important new demand in this field alone.

Numerous new uses for asphalt lie in the field of water conservation, irrigation, and beach erosion.

The United States has some 100,000 miles of unlined irrigation canals. The Bureau of Reclamation estimates that 34 per cent of the water they carry is lost through seepage. The lining of such canals by methods developed by the Asphalt Institute and other groups opens another large market potential.

It has been estimated that a total asphalt demand approximating a full year's production might be realized in the facing of earthen dams proposed for the Missouri River Basin alone. A shortage of aggregate exists in the area for lining the water face of these dams, and asphalt could be used at about 10 per cent of the cost of bringing in stone.

Additional markets loom in beach erosion work. Many public programs are under way along the Great Lakes and the East and Gulf coasts. Some entail new work to protect against wind and water erosion by erecting asphalt groins to catch and hold sand. Others involved rehabilitation of existing breakwater and jetty installations. Asphalt has proven beneficial in consolidating rubble where wood piling needs replacement.

DOMESTIC DEMAND FOR ASPHALT

Year—	Millions of barrels
1935	15.652
1936	20.595
1937	21.876
1938	24.155
1939	27.093
1940	28.182
1941	35.485
1942	35.733
1943	36.404
1944	38.129
1945	38.350
1946	43.253
1947	47.023
1948	49.962
1949	49.362
1950	58.677
1951	66.179
1952	71.007
1953	72.208
1954	76.643
1955 (estimated)	86.000

Production potential . . . The adequacy of asphalt supply was emphasized in the Clay committee study, which noted that production could be doubled to meet increased demands. Basic figures on capacity in this country indicate that this was not an exaggeration. The total capacity in U. S. refineries as of January 1, 1955, stands at about 331,700 bbl. of all types of petroleum asphalt per day *(The Oil and Gas Journal, March 21, page 208)*. This is roughly 60 per cent above the daily average production last year.

As all refiners are aware, there is considerable flexibility in asphalt manufacture, and output could be boosted well over the rated capacity level if a firm demand required it. Feed stocks for coking and other thermal-cracking units could be diverted to asphalt use, and refiners in many instances could switch to heavy crudes to increase asphalt yield. The availability of imports, particularly along the East Coast, contributes further to a potential supply believed adequate to meet any foreseeable demand.

If the market improves according to all indications, refiners will do well to take a second look at their asphalt facilities. Some heavy crudes may come into added use with an improved product realization, as asphalt demand grows. Automatic blending facilities are proving practical in several refineries, and the new emphasis on this heavy product should promote further processing refinements.

Many oil company sales divisions are becoming aware of the over-all returns to be realized from further promotion of asphalt. From the standpoint of highway construction and rehabilitation alone, the plugging of asphalt is considered both timely and profitable.

Cogdell Unit Approved

14,000-acre West Texas unitization project clears Railroad Commission quickly; 60-million bbl. recovery expected

AUSTIN.—The Texas Railroad Commission has quickly approved a big unitization and pressure-maintenance project for the Cogdell field in West Texas. Operators estimate the program will recover 60,000,000 bbl. of additional oil from the Canyon Reef pay.

Approval of the project in Scurry and Kent counties came only a week after it was outlined for the commission *(The Oil and Gas Journal, June 13, page 139)*.

The new Cogdell unit takes in about 14,000 productive acres and 369 producing wells. The unit will convert 19 of these on the perimeter of the field to water-injection service and use another 5 to inject gas along the crest of the structure.

An official of The Texas Co., unit operator, said last week water injection may begin around the first of next year. So far equipment for the lone water injection and treating plant and other needed facilities hasn't been ordered.

Earlier project . . . Operators in the field already have injected about 7.5 billion cubic feet of gas into the field's pay since February 1953 when they started a cooperative project to help maintain reservoir pressure. This program will end July 1.

Only 1 to 3 per cent of total fluid produced from the pool is water. The unit, therefore, plans to obtain the bulk of its water for injection from shallow sand and gravel beds along the Double Mountain Fork of the Brazos River.

Present plans call for starting off with six to eight supply wells in the gravel and adding more if more water is needed. The water-supply area is roughly 15 miles from the northern edge of the field in Kent County. The unit will string about 15 miles of low-pressure water line, coated internally with concrete, from the river to the field.

Gas for injection in the five inputs along the crest of the structure will be residue gas from the Texaco natural-gasoline plant in the field. The plant has a gas-processing capacity of about 25,000,000 cu. ft. daily.

Pressure off . . . The Canyon Reef in Cogdell, which is essentially developed, produces from about 6,800 ft. There is an average net reef section of 108 ft.

Reservoir pressure originally was 3,120 psi. It had declined to 1,430 psi. last May. Results of another pressure survey run last month are not yet available.

No wells are yet being penalized for excess gas-oil ratios, but 27 of the 369 are listed as limited capacity and another 10 as marginal producers.

The unit believes it can hike recovery from a primary estimate of 135,000,000 bbl. to a total of 195,000,000 bbl. by injecting about 30,000 bbl. of water daily plus all available gas.

Operators in the field besides Texaco are Stanolind Oil & Gas Co., D. D. Feldman Oil & Gas Co., Humble Oil & Refining Co., and Chapman-McFarlan Producing Co.

Operator and royalty interest response to the program has been unusually high. More than 99 per cent of royalty interest has signed, and 100 per cent of working interest is going along. Participation in the unit is based on ability of the wells to produce and on net pay.

Texas Eastman Expands New Plant

Demand for its products by plastics manufacturers has forced Texas Eastman Co. to expand the Oxo facilities of its 3-year-old Longview, Tex., chemical plant, shown above. The plant processes propylene obtained from liquefied petroleum gas into n-butyraldehyde and iso-butyraldehyde. The new facilities will increase this output and allow production of other important chemicals, such as proyl aldehydes, amyl aldehydes, and decyl alcohols. Provision also is being made in the new equipment for rapid expansion to produce neopentyl glycol and trimethyl pentanediol if demand warrants.

Oil Firms Win Texas Suit

AUSTIN.—Ten major oil companies have won an antitrust battle with the State of Texas.

The Texas Supreme Court last week threw out the state's 6-year-old suit claiming an illegal agreement existed among the companies to maintain an artificial price structure.

The court reversed a Civil Appeals court ruling the state was entitled to have the suit tried. It upheld the trial court's contention the state failed to show cause for action. Jurists said the state had admitted it had no direct proof of the alleged agreement.

The high court declared the state in seeking the suit had said it would prove an artificial gasoline price structure through "proof of trade association membership, standardization of gasoline, exchange of gasoline, and uni-

form crude-oil and tank-wagon gasoline prices."

"We hold that as a matter of law this will not establish an artificial price structure," the court ruling said.

The latest decision was a reversal of the state Supreme Court's own ruling last October. It declared then the Court of Civil Appeals was correct in holding the state was entitled to a trial on the antitrust issue.

Defendants in the suit were Arkansas Fuel Oil Co., Cities Service Oil Co., Continental Oil Co., Gulf Oil Corp., Humble Oil & Refining Co., Magnolia Petroleum Co., Standard Oil Co. of Texas, The Texas Co., Sinclair Refining Co., and Phillips Petroleum Co.

Gas Hearing Called

Texas seeks uniformity in gas-well metering

AUSTIN.—The Texas Railroad Commission has called a hearing for July 19 on proposals for setting up a uniform method of measuring and reporting gas-well production.

The commission observed, in scheduling the hearing, that there is considerable confusion over how and when gas production should be measured and reported.

The proposed new commission rule would apply to fields where operators have special permission to deliver the full well stream to central separation facilities or to a processing plant.

The commission said gas currently is being measured via at least four different methods. In some cases, two different methods are being used in the same field.

These are the four methods:

... Volume after separation—gas and liquid hydrocarbons are separated on the lease prior to measurement.

... Full well stream—the full stream is removed from the lease and that volume measured and reported.

... Full well stream less shrinkage.—The stream is removed from lease but volume reported accounts for shrinkage that would have occurred if the liquids had been removed by a lease separator.

... Plant residue—the full stream is removed and measured but reported volume is the plant residue gas allocated to the individual wells on basis of the full-well stream measurements.

Ellenburger Pay Extended

ANDREWS, Tex.—Continental Oil Co. 1 McCollum & Means has extended Ellenburger production 1½ miles north of We-Mac field, which is 6 miles southwest of here in Andrews County. The long extender also came in for one of the highest daily flowing potentials in the area.

Location is in Section 13, Block A-44, Public School Lands Survey.

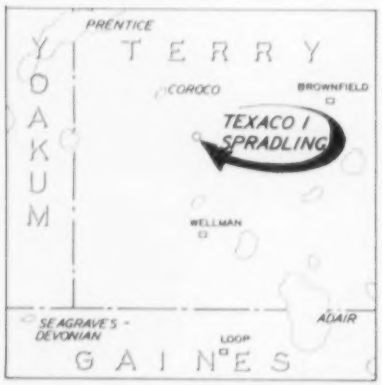
Pay perforations at 13,260-13,306 ft. were washed with 1,000 gal. of mud-acid, resulting in a heavy flow of load oil and acid residue. On completion test the well made 633 bbl. of clean oil in 4 hours through 1-in. choke, giving the well a daily potential of 3,798 bbl. Gas-oil ratio was 421:1. Flowing tubing pressure was 600 psi.

Texas Strike Made

Another Devonian structure indicated by Texaco test

BROWNFIELD, Tex. — Initial tests at The Texas Co. 1 Spradling, deep wildcat 10 miles southwest of here, indicate another Devonian structure.

Sample-top on the Devonian was called at 12,678 ft. A drill-stem test at 12,670-84 ft. had oil at the surface in 1 hour and 45 minutes, then tanked 40 bbl. of oil the first hour and 33 bbl. the second hour. Drill pipe contained another 169 bbl. of oil, plus a small amount of sulfur water. A test at 12,784-12,802 ft. developed 900 ft. of



sulfur water in 2 hours, with no shows.

Casing was run to 12,802 ft., total depth, for completion attempt.

The prospect is 5 miles north of Northwest Wellman field, which has had good production from the Devonian or Siluro-Devonian. The discovery there found the Devonian at 12,687 ft. It was completed for 509 bbl. of oil in 15 hours. Subsequent development at Northwest Wellman proved over 1,800 acres.

Coroco field, 4 miles to the northwest of 1 Spradling, found small production in the Devonian at 12,685 ft. It was later plugged back and recompleted in a Permian zone.

Refining Briefs

CINCINNATI.—Gulf Oil Corp. has placed a third Platformer unit on stream at its Cleves, Ohio, refinery near here. It is similar to the 10,000-bbl. per day unit just completed at Gulf's Toledo refinery. Universal Oil Products Co. designed, engineered, and licensed the unit. Procon, Inc., handled construction.

YORKTOWN, Va. — Survey work has started for major process units to be erected at American Oil Co.'s new 35,000-bbl. per day refinery near here. Construction will begin this summer on an atmospheric and vacuum crude unit, a 30,000-bbl. per day Orthoflow "B" fluid catalytic cracking unit, a 6,000-bbl. per day polymerization unit, gas-recovery facilities, and treating plants to handle gasoline and kerosine. M. W. Kellogg Co. will design and build these units.

NEW YORK.—Manufacturing Chemists' Association, Inc., has issued a new 12-page Water Pollution Abatement Manual dealing with oils and tars. It covers permissible concentrations, oil and tar sources, removal of separable oil from water, and disposal of oils.

HALIFAX, N. S. — Imperial Oil, Ltd., will scrap present water-cooling facilities at its refinery here for a new half million dollar system. A new salt-water pump house will handle 35 million gallons per day under pressure for cooling and serving refinery fire lines. Oil will be removed in a separator before the water is returned to Halifax Harbor. The new system is part of an expansion program designed to boost refinery capacity to 41,625 bbl. per day.

BISHOP, Tex. — Chemical Division of Celanese Corp. of America has started volume production of ethylene glycol diacetate at its plant here. A new process permits economical production of the chemical, which is used as a solvent in cellulose ester lacquers, fluorescent-type paints and printing inks. It also is used as a fugitive plasticizer in baked vinyl coatings and as a perfume fixative.

SAN FRANCISCO.—Bankline Oil Co. directors have approved a $4 million modernization program for the firm's Bakersfield, Calif., refinery. New facilities planned include a coking plant and catalytic reformer. Existing hydrofluoric acid alkylation unit also will be converted into a sulfuric alkylation unit.

Parker Hits In Canada

Oklahoman drills between marginal wells in old field; producer means he gets half of vast New Brunswick lease

Frank J. Gardner

PONCA CITY, Okla.—An Oklahoma independent operator apparently has brought in a payoff well in his first drilling venture under an unusual leasing agreement in eastern Canada.

Orville H. Parker, of Ponca City, Okla., is the enterprising operator. He took up an offer on a 10,000 sq. mile lease in New Brunswick and use of $3 million worth of exploration work. He was to receive 50 per cent interest in the lease, including production from its one ancient oil field, on one condition—he had to boost production on the lease to 3,600 bbl. per month within 500 days.

Parker chose to drill a well instead of applying secondary-recovery methods to the long-producing marginal wells. But he was cagey. Rather than make use of the exploration material, he decided to do infill drilling in the ancient producing field on the lease.

He figured that might fulfill the production requirement. Then he could turn his attention to wildcatting on the large block of untested land. He would have plenty of time for that because the 99-year lease is renewable for another 99 years in 2006 A.D.

Now it appears Parker figured correctly. His first well was drilled between two marginal producers in the old Stony Creek field of Albert County in eastern New Brunswick. It has indicated a potential of more than 100 bbl. daily from Mississippian sand at 2,900 ft. It may be this one well alone will meet Parker's requirement to bring production up to 3,600 bbl. a month.

Begins at Boston . . . The story behind this strange deal began in Boston in January 1954. Parker at the time was trying to sell an Oklahoma oil deal to some eastern capitalists. Among those attending the conference were officials of a small eastern Canadian oil firm, New Brunswick Gas & Oil Fields, Ltd.

"Why don't you send your geologist up to look at our properties?" they queried. "We need help in developing them."

Never a man to overlook a deal, Parker dispatched Geologist Melvin Endicott to eastern New Brunswick at the first opportunity. Back came the word: "This looks good to me."

Negotiations quickly got under way. A contract was signed in November 1954. Under its terms, Parker was to drill six wells on New Brunswick's 10,000 sq. mile concession from the Crown, the first to commence not later than March 1, 1955. If, within 500 days from that date, he had increased production in the area to 3,600 bbl. per month, he would receive half interest in the lease, including present production, then running about 300 bbl. per week.

First troubles . . . Parker wasted no time. The nearest supply stores were in Pennsylvania. Rigs would have to come from Oklahoma. Cement, mud, and pipe also from Oklahoma. Sand from Illinois. Assembling a complete drilling outfit on the ground in New Brunswick was no easy job. It's 800 miles from Pittsburgh, and 1,800 from Tulsa. On March 1, the Walker-Neer cable-tool rigs hadn't arrived. So Parker spudded with a water-well machine.

After 6 weeks' drilling time and three fishing jobs, oil flows were found in three sands of the Albert-Mississippian formation at 2,706-40 ft., 2,800-24 ft., and 2,905-89 ft. In all, 135 ft. of saturated sand was logged. Of this, 90 ft. is expected to be net effective pay. The well is not yet finished, but total depth of 2,989 ft. has been reached, and first perforations have been made at 2,925-53 ft.

Parker will set plug and do selective fracture jobs at different levels, later commingling for final potential test. The fracture treatments employ 2,000 lb. of sand and 2,000 gal. of oil each. A final potential well in excess of 100 bbl. per day is anticipated. The initial natural flow at 2,905 ft. reached 108 bbl.

Background . . . Stony Creek field was discovered in 1909. Across the Petitcodiac River to the east, and also within the concession, is the abandoned Dover field, site of Canada's first oil wells. It was here in 1859 that Dr. H. C. Tweedel punch-drilled five shallow wells to depths of 100 to 190 ft. in an attempt to beat Colonel Drake to the draw in finding North America's first oil field. His wells were down, actually, before Drake's, but water troubles prevented a successful completion until after Drake's success at Titusville.

These old holes, according to Parker, are still full of oil. He is also considering this area for future rejuvenation.

The scene of these interesting operations is a 10,000-sq. mile concession granted to New Brunswick Gas & Oil Fields, Ltd., by King Edward VII on August 16, 1907. It covered Kent, Westmorland, Albert, Kings, Queens, and Sunbury counties and was good for 99 years. By applying 6 months before the expiration in 2006, Parker can renew the lease for 99 more years. That will give him until 2105 A.D. to explore if he succeeds in producing 3,600 bbl. per month by July 14, 1956.

Since the original discovery in 1909, operators have drilled 135 wells at Stony Creek. Of these, 25 were completed as oil wells, and 86 as gassers. About 25 billion cubic feet of gas and nearly 600,000 bbl. of oil have been

produced from the field. At present, about 54 wells are producing gas, and 17 are pumping oil intermittently. Many of the connected gas wells also make small amounts of oil.

The $3 million worth of exploration work was undertaken in the late 1940's and the early 1950's by a major American oil company, at the invitation of New Brunswick Oil Fields, Ltd.

An extensive seismic program and gravity surveying over much of the 10,000-sq.-mile concession led the major company to sink four wildcats to depths of 1,050 to 5,343 ft. and one deep wildcat to 8,229 ft. These were all in the immediate vicinity of Stony Creek and all were dry. Upon withdrawing from the area, the company yielded copies of all exploration work to New Brunswick. Although no new fields were found, the program shed much additional light on the geological conditions in the area.

The oil produced at Stony Creek is 37° green Pennsylvania-type crude, bringing $3.00 per barrel. It is shipped by rail to refining facilities that are near at hand, and a gas-gathering line carries the gas from Stony Creek to Moncton and Hillsboro. There is no government regulation on production, and the gas sells for 75 cents per M.c.f. Royalty paid to the Crown is only 5 per cent.

Parker estimates the cost of his first well at $100,000. After ironing out shipping problems, and cutting costs of operation, he hopes to be able to sink a well for less than half that amount. He counts on 30 days to drill and 2 weeks to test for each future well.

"It's just like operating in Oklahoma," says Parker. "Why, you know, we have a paved road only 300 ft. from our well! All those folks need up there is a little up-to-date know-how."

(For more about New Brunswick oil, see page 151.)

Oil Men Form Tax Society

CALGARY.—Canadian oil companies have formed a tax society with 60 charter members.

Main purpose of the Canadian Petroleum Tax Society is to encourage and promote a ready exchange of information regarding application and interpretation of tax statutes and legislation at all levels of government.

D. M. McGeer, Sun Oil Co., was elected president; J. B. Fraser, Canadian Gulf Oil Co., first vice president; J. R. McCormick, Shell Oil Co., second vice president; O. C. Windren, Texaco Exploration Co., secretary; R. G. McCallum, Western Leaseholds, Ltd., assistant secretary; W. H. Atkinson, Oilwell Operations, Ltd., treasurer. Directors include M. P. Rollick, Socony-Vacuum Oil Co. of Canada, Ltd.; W. Mitchell, General Petroleums of Canada, Ltd.,; and L. L. Seville, Imperial Oil, Ltd.

Shell-Imperial Deal Reported

CALGARY.—Shell Oil Co. reportedly is negotiating a deal with Imperial Oil, Ltd., to acquire Imperial's producers and freehold rights in the Midvale area of southern Saskatchewan.

Imperial has four producers in the area and rights covering about 6,000 acres.

Shell reportedly will be required to repay Imperial the costs for drilling and equipping the four wells. Imperial is scheduled to retain an override royalty on crude production from the 6,000 acres.

Williston Line Recommended

OTTAWA.—The House of Commons railway committee has recommended incorporation of Stanmount Pipe Line Co., which proposes a crude-oil pipeline from North Dakota into southern Manitoba.

Stanmount plans to pipe Williston basin crude through its line to a connection with Interprovincial pipeline near Cromer, Man. The crude would then go into the U. S. or eastern Canada. Stanmount's line will be a 140-mile, 10-in. carrier.

Clifford J. Smith, speaking for the pipeline, told the committee that in time of emergency the line would make the enormous crude-oil reserves of the Williston basin readily available.

A subsidiary has been incorporated to build and operate the U. S. section of the line, Smith said.

Crude-Line Tariff Set

REGINA.—South Saskatchewan Pipe Line Co. has announced a 77-cent tariff for transporting Fosterton-Cantuar-Success medium gravity crudes from its Cantuar pump station to St. Paul, Minn.

The crude will be carried via South Saskatchewan Pipe Line to Regina, by Interprovincial Pipe Line and Lakehead Pipe Line to Clearbrook, Minn., and by Minnesota Pipe Line Co. to its destination. No announcement has been made regarding local tariffs for delivery to points en route.

Movement of line-fill crude for the Minnesota pipeline started from Cantuar station June 1. It is understood that producers in the Fosterton, Success, and Cantuar fields are delivering 10,800 bbl. a day to the line.

The price of the Saskatchewan crude at the St. Paul terminal is $2.2516 per barrel. This includes the posted field price of $1.29, gathering cost of 10 cents, pipeline tariff of 77 cents, U. S. import tariff of 5.25 cents, delivery charge of 1.8 cents at the St. Paul end, and incidental charges.

New Supply Goes Into Transco System

An added 40 million cubic feet of natural gas daily started flowing into Transcontinental Gas Pipe Line Corp.'s system recently when the valve above was opened. Russell M. Riggins, right, president of Texas Gas Corp. and Texas Gas Pipe Line Corp., helps E. Clyde McGraw, Transco's vice president of operations, send the new supply into the Texas-to-New York system. Texas Gas, which sells the gas to Transco, built a 1,600-hp. compressor station near Orange, Tex., as part of the sale. Transco laid 27 miles of 12-in. line from its trunk line to pick up the gas. The gas enters the system near Starks, La. It comes from fields in four southeastern Texas counties.

Tanker Arrives in Alaska . . .

. . . Delivers First Fuel for Line

HAINES.—Testing will begin this month on the 625-mile Haines-to-Fairbanks pipeline which will deliver fuel to America's military bases in Alaska.

First oil has arrived at this tiny southeastern Alaska port by tanker via the Inside Passage waterway, the protected route along Canada's west coast. The 50,000 bbl. of diesel fuel was pumped into storage tanks for initial phases of 3 to 4-month testing process.

Later, it will be pumped ahead to the five stations for testing each individual piece of equipment. By this fall, the pump stations and the entire length of the 8-in. steel line which cost $40 million to lay will have been checked out, the U. S. Corps of Army Engineers announced.

Deliveries to Ladd Air Force Base will begin about September 1.

Contractors will operate the pipeline for another month before turning it over to the military.

Late this fall, the pipeline will begin regular operations.

Final touches are being applied on the gigantic job which some thought to be virtually impossible Clean-up crews are at work. Mile-post markers, tilted for aerial observation during pipeline operations, are being placed along the 50-foot right-of-way.

Engineers are getting pump stations ready to push the fuel on its long journey across lakes and rivers, down frozen valleys, through forests and over ice-covered mountains to the terminal at Fairbanks.

The last joint of pipe was welded late last year, less than 6 months after crews began work on the line.

The entire project includes a dock and terminal at Haines, five pump stations, a terminal at Fairbanks, storage, housing, and related facilities. The line stretches across 285 miles of the Canadian Yukon.

The joint venture was handled by Williams Brothers Co., Tulsa; McLaughlin, Inc., Great Falls, Mont.; and Marwell Construction Co., Vancouver, B. C. Williams Brothers did the actual pipeline construction. Marwell had the contract for the pump stations.

Williams Brothers, though not the first to build a pipeline in Alaska, was faced with a trail-blazing job almost from beginning to end. Not the least of the obstacles was the 100 miles of permafrost, the eternally frozen earth which some oldtimers of the Arctic said could not be ditched.

Williams Brothers fabricated its own ditching machine. It was designed especially to cut the permafrost.

Pipeline crews had to reverse the established procedures of ditching, stringing, welding and covering pipe. The ditches would not remain open.

Pipe instead was strung, welded, and then laid into the ditch right behind the machines before the frozen mud and water mixture—converted into an unmanageable ooze when exposed to the sun—could slough off the trenchside.

Even this trick did not conquer the unruly elements. With the return of winter, the soil began to freeze again. Crews suddenly found the pipeline back on the surface. Solidifying from the bottom up, the earth had shoved the buoyant pipe out of the trench.

Pipe had to be reburied. The problem finally was whipped by anchoring the line with 300-lb. concrete blocks about every 40 ft. in sections where it refused to remain bedded down.

Sinclair Pact Signed

Strike by 10,000 oil union workers averted by last-minute agreement; workers get pay hike, other improved benefits

NEW YORK.—A threatened strike of 10,000 Sinclair Oil Corp. workers over the country was averted late last week. Negotiators for the CIO Oil, Chemical and Atomic Workers International Union and management agreed on provisions of a new contract. The agreement was reached after an all-night bargaining session at the Park Sheraton Hotel here.

It provided a 10-cent hourly wage increase retroactive to March 1 and substantial improvements in sickness and accident benefits and other contract provisions. Bargaining still continued with an early agreement expected on contract benefits covering hospitalization and group life insurance and pensions.

The wage increase accepted by the union was the same amount first offered by Sinclair in mid-April. The union, however, held out then for new contract provisions covering grievance procedure and further limitation of contracting work to outsiders.

The union contract actually expired last July 31 but was continued on a day-to-day basis. The union in April, however, terminated the arrangement and called a strike. The walkout was to take effect if agreement was not reached after a 60-day waiting period. The strike deadline was extended early last week and actually had expired shortly before the agreement was reached.

Pact praised . . . Ben J. Schafer, O.C.A.W. vice president and coordinator of the Sinclair council, said "vigorous negotiations on both sides led to an amicable settlement. It represented the proper give and take between the parties. Concessions made by both sides reflected true spirit of collective bargaining."

Millard E. Stone, Sinclair's director of industrial relations, stated "we consider this a good contract for the companies as well as their employes. The latter will especially benefit from the increased sickness and accident allowance."

O. A. Knight, O.C.A.W. president, reported "Sinclair employes have achieved the best sickness and accident benefits in the petroleum industry and improved job security." He added the contract gives "new protection against contracting out of work within our jurisdiction and better transfer machinery in event of refinery layoffs."

The new contract will be presented to union membership for ratification in accordance with union constitution.

The agreement covers workers of the parent company and four Sinclair subsidiaries, Sinclair Oil & Gas Co., Tulsa; Sinclair Pipe Line Co., Independence, Kans.; Sinclair research laboratory, Harvey, Ill.; and Sinclair Refining Co. Refineries are at East Chicago, Ind.; Marcus Hook, Pa.; Corpus Christi and Houston, Tex.; Wellsville, N. Y.; and Sinclair, Wyo.

Others get raise . . . Employes at Sinclair's Hartford, Ill., refinery were not included in the CIO agreement because they are members of an American Federation of Labor union. They were offered a similar contract package last March 16, retroactive to March 1, and accepted the contract in April.

Sinclair also gave its salaried employes a 4 per cent pay increase March 31 retroactive to March 1 with a maximum increase of $50 monthly.

The CIO contract with Sinclair covers the largest single group of workers in the industry and is the only one negotiated on a national basis.

Tools for Drilling, Producing Are a . . .

. . . Billion Dollar-Plus Business

BANFF, Alta.—Oil industry equipment manufacturers sell more than a billion dollars' worth of drilling and production tools annually.

Members of the Petroleum Equipment Suppliers' Association learned the dollar volume of their business at their annual convention here last week. H. R. Safford, Jr., executive secretary of the association, detailed them in a report on a survey made by the Business and Defense Services Administration of the Department of Commerce.

Safford pointed out the survey pin pointed steel tonnage required by firms manufacturing primarily for the oil industry. The survey will be made annually, he said, and can be used in case of another war emergency to substantiate claims for allotments of controlled materials.

The survey showed $929,245,866 was spent in 1954 for drilling and producing equipment and services. This is an increase of $22,245,866 over the 1952 outlay.

An additional $384,517,727 was spent for 2,290,906 tons of casing and tubing. This compares with $255,971,000 spent in 1952 for 1,534,311 tons.

The tubular goods were used in 53,390 wells in 1954 with footage totaling 219,010,000. Average well depth was 4,061 ft., requiring an average of 13.6 tons of steel for each 1,000 ft. of well drilled.

Houston leads . . . Safford revealed that 61.9 per cent of all drilling and producing equipment was sold through firms in four areas—Houston, Los Angeles, Tulsa, and Dallas-Fort Worth.

M. E. MONTROSE
. . . New P.E.S.A. President

Houston sold 34.1 per cent of the total while Los Angeles had 11.3 of the business, Tulsa 10.5, and Dallas-Fort Worth 6.

The 1954 usage of carbon steel by the oil industry was 478,422 short tons. Alloy steel usage was 204,770 short tons. Stainless steel accounted for 5,372,000 lb.

Officers elected . . . The suppliers at the convention's business session elected M. E. Montrose, vice president of Hughes Tool Co., Houston, president.

Rainey Elliott, president of Jones & Laughlin Steel Corp. Supply Division, Tulsa, was elected vice president.

1965 Oil Peak Seen

Slow decline predicted after crude production reaches 3,000,000,000 bbl. annually; imports to be expensive

Henry D. Ralph

DENVER.—Crude-oil production in the United States will reach its peak at about three billion barrels per year in 1965 and then begin a slow decline.

That was the prediction of Eugene Ayres, consultant for Gulf Research Co., in a paper prepared for delivery before the Interstate Oil Compact Commission which met here June 16, 17, and 18.

Looking ahead 20 years, Ayres said that by about 1975 it seems possible that:

. . . **We shall have to import** more and more oil to make up for domestic shortage, and as 1975 approaches, importation will become more expensive and more difficult to arrange.

. . . **Domestic oil will cost more** to find and to produce.

. . . **Natural gas** will be in short supply.

. . . **Electric power** will be of increasing importance even for space heating.

. . . **Coal will begin** to increase in cost because of a shortage of "cheap" bituminous.

. . . **Shale oil** will be in high commercial production.

. . . **Lignite and other** low-grade coals will be processed on a large scale for liquid fuel and for generation of electric power.

The big question mark in future energy resources is nuclear energy, Ayres said, and many of these forecasts could be upset by successful development of cheap nuclear energy.

However, he expressed the belief that nuclear energy may not supply more than 10 per cent of our total energy by the end of the century and that by 1975 its percentage will be so small as to make little difference in the over-all situation.

The United States probably has about 90 billion barrels of oil yet to be produced, counting both discovered and undiscovered reserves and allowing for technological improvements in finding and producing methods, Ayres said, and the rest of the world possibly as much as 1,266 billion barrels.

But regardless of the exact figures, he predicted that production will continue to rise to conform with demand, as long as this is physically possible; that the curve of production will finally reach a peak and will bend over and bend downward; and that crude production will then start a long gradual decline.

"We shall be producing oil for centuries but at a gradually decreasing rate," he said. "While demand will presumably keep going on up, supply will keep going down and oil will be increasingly expensive to find and produce."

Demand surges . . . The domestic demand for liquid fuel by 1975 was set by Ayres at somewhere between 4.5 and 5.5 billion barrels per year. But he said it looks as though we will have only about 2 billion barrels of domestic crude production then.

The world as a whole will have a demand for about 10 billion barrels in 1975 but will have only about 7 billion barrels of production, he said.

"With this indicated world shortage," Ayres continued, "importation may not be economical or even possible."

The future of natural gas is harder to predict, Ayres said, but taking the highest estimates which have been suggested it is likely that gas production also will reach its peak about 1965 at about 12 trillion feet but the supply will be only 11 trillion, he said.

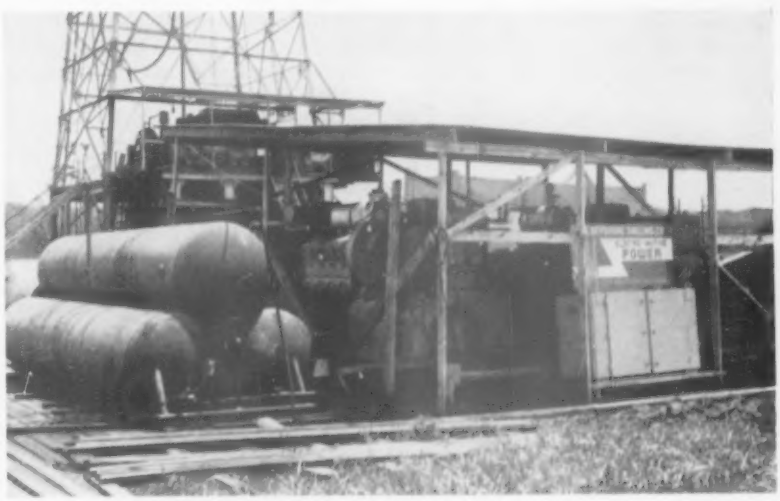
Large quantities of shale oil probably can be produced at fairly reasonable costs, Ayres predicted. But during the first 20 years of this operation only about 7 billion barrels would be produced after an investment of 7 billion dollars.

"The second 20-year period would be more productive," he said, "but by 1975 annual shale-oil production would probably be under a billion barrels per year—perhaps one-third of our domestic liquid-fuel deficiency at that time."

Coal overestimated . . . Estimates of this country's reserves of coal which can be produced economically are much too high in Ayres' opinion. And he said that the peak of easily available bituminous coal (about 900 million tons per year) will come about 1975. Then demand may exceed production by about 50 million tons.

From this he reasoned that little or no bituminous coal will be available for liquid-fuel production. Therefore, any plans for liquid fuels from coal should be based on cheaper and less wasteful processes than now contemplated and should be applied to subbituminous or lignite.

Nuclear power operating on uranium fission may be obsolete before it gets started, Ayres said, if the "gleam in



First Packaged Diesel-Electric Rig Unit in Use

Offshore Drilling Co. of Baton Rouge, La., is using a new diesel-electric rig power plant to drill this well near Houma, La., for Louisiana Prospect Co. The power plant is assembled into a small, compact package, with all components designed and built by one manufacturer. There are two 875-hp. two-cycle diesel engines, each coupled to a d.c. generator. Each engine-generator unit, together with generator control cabinet and engine-cooling apparatus, is mounted on a portable skid. Electricity is supplied to four 625-hp. motors which, singly or in pairs, supply power for the mud pumps, draw works, and rotary table. This integral power unit brings the advantages of electric power to the deep-well or offshore rig at a cost comparable to mechanical power plants. Total cost for the power plant varies from $180,000 to $350,000, depending on the power required and the rig layout. The unit is manufactured by the Electro-Motive Division of General Motors Corp.

the eyes" of some scientists becomes a reality. This is the possibility of power from controlled fusion of lithium hydride, which could get away from the many really serious drawbacks of uranium fission.

Cost main problem . . . Such developments, the application of solar energy, and the possibility of producing power directly from chemical reactions of fuels without the intervention of an engine would upset all predictions, Ayres said. But he does not anticipate them before the end of this century.

He also discounted the importance of the Athabasca tar sands, saying that economic incentives will not be great enough to encourage their development within the next few decades.

The world is now entering a period of rapidly growing demand for energy and during the next 20 years the major concern will be to provide energy economically. He said there is no need to worry that our ultimate reserves of fuel sources are about to run out, but there will soon be serious problems of how to put these resources to use at reasonable costs.

Planes operate from . . .

Fuel Stored Underground

. . . In Air Force Test

WASHINGTON.—Quality control is the big problem in underground storage of motor fuels.

This is indicated by experiments made by the Air Force in the use of salt caverns. It found that jet fuel could be stored underground without damage. But it found, too, that aviation gasoline lost its oxidation inhibitors from acid solutions which developed.

The loss of inhibitors can be reduced by measures to control the amount of acid. It may be less of a problem in motor gasoline. But military experts hint strongly that the oil industry should do some research on underground storage. Some day, they say, it will be a big factor in taking care of swings in demand as well as in national security.

The Air Force is interested because of the need to provide reserve-storage capacity for emergency operations at bases in strategic locations. Underground storage is less vulnerable to air attack and is cheaper than conventional aboveground tankage.

The idea of underground storage for defense is not new. It was seriously advanced during World War II. However, hearings before congressional committees dealt chiefly with sunken tanks. They would be better protected against enemy attack, but they would be much more costly than aboveground tanks. Nothing came of any of the proposals.

Today, however, underground storage means putting products into natural or man-made caverns, some going several thousand feet below the surface. Natural gas and L.P.G. are being stored in this way. The Air Force wants to find out if refinery products can be stored without deterioration.

Early tests . . . The Air Materiel Command at Wright-Patterson Air Force Base at Dayton, Ohio, has been working on the matter since 1952. It has studied storage in impervious rock from the standpoint of feasibility, but its actual experiments have been confined to salt caverns.

In 1952 tests were made on a small scale near Wichita, Kans. Lots of 60,000 gal. of jet fuel were held in a salt cavern for 3 to 6 months. The fuel was later tested and found satisfactory. Tests on aviation gasoline, however, showed a rapid loss of the oxidation inhibitors that retard the precipitation of tetraethyl lead and the formation of gum.

Proposed test . . . The results of the jet-fuel test were good enough to lead the Air Force to try out salt-cavern storage on an operating scale. The Armed Services Petroleum Purchasing Agency now is looking for a contractor to provide and service 300,000 bbl. of storage capacity.

The new storage also is to be in Kansas, in the vicinity of Wichita or McPherson. Three caverns are to be provided, each holding 100,000 bbl. of jet fuel. The fuel is to move in by a pipeline capable of a constant rate of 1,200 bbl. per hour. It will also be moved out by pipeline, or if necessary by tank truck. The set-up will have a possible throughput of 1,200,000 bbl. a year.

This will be a continuing test. It will develop whether any "bugs" show up in use in jet planes that did not show in the test engines. If it works out, underground storage will save two things vital in war—steel and money.

Industry Briefs

MIDLAND, Tex.—Texas-New Mexico Pipe Line Co. will lay roughly 9 miles of 4-in. crude line in Lea and Chaves counties in southeastern New Mexico to take crude from 18 producing wells on 14 leases in Caprock pool.

ODESSA, Tex.—Cities Service Pipeline Co. is laying 11 miles of 4-in. pipeline to handle crude formerly trucked out of South Cowden (Ellenburger) field of Ector County, West Texas. The line, slated for completion before the end of the month, will tie in with Cities Service Pipeline's system at its Foster pump station.

NEW ORLEANS. — A new barge-shaped cargo vessel with a liquid capacity of 3,600 bbl. and deck capacity of 69 tons has been commissioned by Pure Oil Co. at Madisonville. The vessel will be placed in immediate service with Port Arthur, Tex., as its base. It will be used to carry drilling equipment, fresh water, mud, and diesel fuel to Pure's drilling and production platforms in the Gulf of Mexico.

HOUSTON. — Pan American Pipe Line Co. has changed its name to American Oil Pipe Line Co. No changes will be made in officers or management, according to Ira O. Walker, president. The company is a subsidiary of American Oil Co., New York.

NEW ORLEANS. — Operating and maintenance employes of Lion Oil Co.'s Barton plant at Luling, La., have rejected the Oil, Chemical and Atomic Workers International Union, CIO, as their bargaining agent. A National Labor Relations Board election resulted in 50 ballots favoring the union and 210 against.

BOULDER, Colo.—The first annual Rocky Mountain mineral law institute will be held at the University of Colorado here July 21-23. Specialists in oil, gas, mining, and taxation law from over the nation are expected.

BRADFORD, Pa.—Stockholders of South Penn Oil Co. have approved merger of Pennzoil Co. into South Penn Pennzoil was primarily engaged in refining, marketing, and distribution of merger of Pennzoil Co. into South Penn. was majority owner of the company. Pennzoil now will operate as a division of South Penn. Executive offices will be in Oil City.

Jet Fuels in Trouble

The new jets are particular, refiners are told; fuels now must have "thermal stability," leave no sediments

ATLANTIC CITY.—Refiners making jet fuels appear to be up against a new problem. They will now have to contend with another specification—thermal stability.

Until recently, fuels made to JP-4 specifications have caused refiners relatively few headaches. With no stringent quality requirements, they needed little processing. In fact, they afforded new outlets for some low-grade distillate fractions which had been crowded out of the motor-fuel picture by the current octane race.

But jet fuels now show indications of following the general trend of all petroleum products. Higher quality requirements will demand limited selection of base stocks, more processing, or use of additives—or combinations of all three.

The problem . . . The trouble arises from the more severe conditions imposed by the high-performance jet engines used in military interceptors and long-range bombers. Many fuels considered adequate up to now have been found to form insoluble sediments which clog fuel systems in these new supersonic aircraft.

The cause of this new trouble is the higher temperatures to which jet fuel is subjected during flight. At supersonic speeds, air is heated by friction and compression and can no longer be used as a cooling medium. So designers have turned to the fuel itself as a coolant for lubricating oil, radar, hydraulic systems, and air conditioning.

This "heat sink" concept is apparently here to stay. It cannot be avoided, say aircraft designers, without giving up the efficiency and performance demanded by the newer craft.

Hence the problem of making jet fuels withstand these higher temperatures without causing burner trouble falls to the refiner. The problem is aggravated by the closer clearances in new jet-engine fuel-system components which allow little or no deposit formation.

While the thermal stability problem is relatively new for many refiners, it was anticipated some time ago. A number of studies have outlined what needs to be done to evaluate and correct the situation.

The subject was thoroughly reviewed last week as the Society of Automotive Engineers met here for the Golden Anniversary summer meeting. Four papers from the petroleum and chemical industry comprised a progress report and pointed to further lines of study.

Stability tests . . . The first requirement was a laboratory method for testing jet fuels for thermal stability. Such a method now gaining wide acceptance was outlined by A. B. Crampton, W. W. Gleason and E. R. Wieland of Esso Research & Engineering Co.

They first looked at the normal routine fuel tests for gum, aromatic and sulfur content, bromine number, etc. None of these showed any value in this respect, so they turned next to a static bomb test. This also showed drawbacks, and a dynamic flow test apparatus was employed.

Relatively new, this Erdco rig amounts to a scaled-down version of a turbo-engine fuel system. Heated fuel is passed through a heated sintered metal filter. Fuels are rated relatively by the amount of time they will operate before the filter is plugged.

A yardstick to judge the Erdco test was provided by a full-scale mock-up system built by Pratt & Whitney Aircraft. This comprised a fuel-oil heat exchanger, a single combuster and associated control equipment.

While it is still too early to say whether this laboratory test will adequately predict operating aircraft performance, initial results are reported by Esso as promising. Nine different fuels have been aligned roughly in the same performance order as in Pratt & Whitney's full scale mock-up. The Esso authors believe that more precise correlation may be possible by proper selection of flow rates and temperatures in the Erdco test.

Fuel ratings . . . Studies of various types of jet-fuel stocks have already indicated their relative quality regarding thermal stability. As expected, a heavy acid-treated stock, being highly paraffinic, showed good stability. So has an untreated alkylate bottoms fraction. Surprisingly, a high rating in the full-scale mock-up test was chalked up by a stock with high sulfur and aromatics contents, although it performed poorly in the Erdco test.

Of marginal acceptability were an untreated fuel from a naphthenic crude, and a raffinate fraction from SO_2 extraction of a mixed aromatic-paraffinic, high-sulfur kerosine.

At the bottom of the quality list were a lightly acid-treated low-solvency mineral spirit, untreated and SO_2 extracted kerosine samples from aromatic crude sources, and JP-4 referee fuel itself. In fact the latter showed the poorest stability of all of the nine fractions evaluated in both tests.

Why some of these fuels rate as they do is not clear at this time. But research is continuing, to obtain a better conception of what might be done through proper selection of blending stocks and product segregation for high-performance requirements.

Practical disadvantages in this attack on the problem were noted by the Esso authors. They include increased handling, higher storage costs, and loss of over-all availability of jet fuel.

Process possibilities . . . Further processing also appears promising but at a price. Acid treating seems to show results, said Esso, but further light needs to be shed on what degree of treating is required for various base stocks.

The value of SO_2 extraction is questionable. The Erdco test shows some improvement from this separation step, but the full-scale installation does not.

Hydrogen treating should show improvement of some base stocks, but again, the degree of improved stability obtained is not yet fully determined. Hydrotreating of an untreated aromatic kerosine and of the JP-4 referee fuel showed significant quality improvement and further tests are under way.

Additives . . . While the use of additives is agreed to have potential merit, there exists some difference in evaluating them for the present.

The Esso authors reported that their early tests of the conventional oxidation inhibitors proved of little value. They have turned to other additive types and have found some to be definitely promising.

A note of caution was injected by Esso. It is not enough to test the effect of additives on thermal stability of base stocks. Their possible side effects must also be investigated. Otherwise new problems such as altitude foaming, emulsions, or interference with low-temperature flow may arise.

Further light was shed on the additive question by C. M. Barringer of Du Pont Co. He verified the general lack of results from conventional low temperature antioxidants.

From analysis of engine deposits, the Du Pont study indicated that nitrogen, sulfur, oxygen and other non-hydrocarbon constituents of jet fuels were the trouble makers. Removal of these materials by adsorption on alumina bore out this conclusion by greatly improving the stability of the re-

maining fuel constituents in an Erdco test.

Barringer noted that an effective additive must do two things:

It must stabilize a fuel at normal temperatures during storage.

It must disperse residue at high temperatures.

The relative merits of various additives in providing stability control during storage have been determined.

A number of metallic and nonmetallic dispersants have also been tested. One of the latter types was selected for further testing on the basis of its initial showing.

Constant improvement in high temperature stability of twelve different fuels was reported, using this additive in the Erdco test. In most cases, said Barringer, it upgraded poor or marginal fuels to the trouble-free category.

Barringer concluded that development of suitable additives appears entirely feasible. He noted the need for improved testing techniques, however.

Although correlation between flight conditions and the Erdco test is still somewhat meager, he agreed that those fuels which showed poor stability in the laboratory test could be expected to cause difficulty in flight. There is less evidence to assure that a fuel showing a long Erdco test duration will permit long-term engine operation, he pointed out.

A. C. Nixon, C. A. Cole, and H. B. Minor of Shell Development Co. presented results of their studies on the problem, and reviewed past data on storage stability tests. In their high-temperature stability studies, they found straightrun stocks from Mid-Continent and West Texas crudes to be substantially better than a catalytically cracked stock and a California straightrun fraction.

A further refining step—the more severe hydrocracking process—was suggested as a promising one by D. P. Heath of Socony Mobile Laboratories. This process, Heath said, produces a high-quality jet fuel and promises to increase the availability of the JP-5 specification product.

With co-authors C. W. Hoffman and J. H. Reynolds, Heath discussed stability tests using the Erdco method on a number of straightrun and treated fractions with and without additives. They reported that refining procedures give more significant stability improvement than additives, hence their work emphasized the former.

Since they believed the less-volatile JP-5 fuel may be desired for high-speed aircraft, they devoted more attention to that specification product.

Like other investigators, they found that solvent extraction, hydrotreating, acid treating and additives showed varying results with different base fuels. They found in general that additive response was improved in fuels which had some prior processing.

Hydrocracking . . . A jet fuel produced by hydrocracking of heavier fractions retains its stability for long periods at 400° to 500° F., said Heath. Such a fuel with an additive also developed by Socony Mobil provides a stability far greater than believed necessary for supersonic aircraft.

The hydrocracking process developed by Socony uses a specially designed catalyst which converts heavier crude fractions to JP-4 and JP-5 products in a hydrogen atmosphere. Although temperatures and pressures are higher than for the mild hydrotreating process, the new catalyst permits hydrocracking at pressures lower than those used conventionally by the Germans, they reported.

In addition to the high thermal stability and increased availability of the less-volatile JP-5, they cited an increase in combustion, heat content per pound and hydrogen saturation for the hydrocracked product. Several barrels of the new fuel are being produced in a pilot plant at the Paulsboro laboratories for military testing, they reported.

The outlook . . . While the symposium served mainly to present a picture of the present stage of study on the thermal stability problem, it also indicated some possible solutions. All possible measures which might be taken mean higher producing costs for jet fuels.

The difficulty at present is restricted to only a fraction of the military requirements. But the trend toward higher performance and efficiency in jet aircraft promises to broaden the base of demand for higher-quality jet fuels.

It seems almost certain that a new specification concerning stability will be written into military contracts, as soon as one can be developed.

Pennsylvania Has Big Gasser

RENOVA, Pa.—One of the biggest gas wells ever brought in east of the Mississippi River has been brought under control after being set afire while being capped.

The gas strike, 12 miles north of here on the Potter-Clinton County line, is a New York State Natural Gas Co. well. It has an estimated production of 149 million cubic feet of gas per day. The well is the fourth in the new Greenlick field of north-central Pennsylvania.

The new field was opened last January by New York State Natural with prolific gas production from the deep Oriskany sand. It is located on the southeastern flank of the Wellsboro anticline. It is northeast of Leidy and Tamarack pools, opened in 1950 and 1952, respectively. The second well in the new field made 45,000 M.c.f. per day. Rock pressure was 4,030 psi. The wells are being produced under heavy back pressure.

The well was ignited to avert an

Synthetic-Rubber Output Off 27 Per Cent

SYNTHETIC-RUBBER production last year totalled 1,434,962,000 lb., according to preliminary figures released last week by the U. S. Tariff Commission. This was a decline of over 500 million pounds, or 27 per cent, from 1953 production.

Most of the decline took place in GR-S output from government-owned plants which have since been purchased by private industry. During the last year of Government ownership these plants showed a 31 per cent drop in production. This was the first time that output of GR-S had dropped below the billion-pound mark since 1950.

Prices edged up slightly on the whole, due to a 1-cent rise in GR-S, the largest tonnage synthetic. Total production and unit value on sales for the past 3 years are shown in the following table:

U. S. SYNTHETIC-RUBBER PRODUCTION

	1954		1953		1952	
	1,000 lb.	Cts. lb.	1,000 lb.	Cts. lb.	1,000 lb.	Cts. lb.
CYCLIC ELASTOMERS:						
Polybutadiene-styrene type (GR-S, Buna S)						
Government plants	966,813	23	1,413,097		1,392,982	
Private plants	6,436	63	1,847		577	
Total	973,249	24	1,414,944	23	1,393,559	24
ACYCLIC ELASTOMERS:						
Polybutadiene-acrylonitrile type (N-Type)	47,933	50	45,244	50	36,351	50
Polychloroprene type (Neoprene)	154,899	42	180,308	41	147,269	38
Polyisobutylene-isoprene type (GR-I, Butyl)	130,116	22	175,923	21	177,787	21
Polyvinyl type	104,973	56	118,364	58	112,697	56
All other	23,792	70	23,567	73	21,220	82
Total	461,713	41	543,406	40	495,324	28
Total all synthetic rubber	1,434,962	29	1,958,350	28	1,888,883	27

explosion. Paul Adair, Houston explosives expert, was called in to help cap the well. It burned about 24 hours before being shut in.

Tanker Strike Called

NEW YORK.—Oil tankers chartered under the American flag are strike bound.

A strike was called late last week by unions representing 28,000 seamen and officers against American ship owners after negotiations for a new contract "broke down."

Ships already in port were allowed by the union to unload their cargoes and leave. But the strike embargo was clamped against tankers at sea, preventing their entering and unloading.

Officials of refineries and oil terminals in this busy port, however, reported they would not be seriously crippled at least for a time. They noted that tankers flying foreign flags still could enter port and discharge cargoes.

Unions involved are the CIO National Maritime Union and unions representing marine engineers, masters, mates and pilots, and radio engineers. representatives had been negotiating with owners of some 200 tankers.

ROCKY MOUNTAIN

Important Test Hits

Atlantic well may be best strike of year for Rockies

BILLINGS, Mont. — Atlantic Refining Co. last week reported what may well be the most important discovery so far this year for the Rocky Mountains.

The company recovered 6,100 ft. of foamy oil (15 per cent oil) on a drill-stem test of the Amsden dolomite at I Horton estate, 15 miles southwest of Melstone field and 24 miles south of Amsden production in Northwest Sumatra field.

The indicated discovery, now coring ahead after circulation troubles, flowed oil after 15 minutes of a 26-minute test at 6,108-25 ft. There was gas at the surface in 8 minutes. Flowing pressure ranged from 1,760 to 2,795 psi. No rate of flow was reported.

This Central Montana Plains wildcat is the first production for Yellowstone County.

Northwest Sumatra field, nearest Amsden production, is one of the three on the Montana Plains where Amsden dolomite produces. Amsden oil is found at Gage Dome and Big Wall fields. Outside the Williston basin area, Northwest Sumatra has been the most active area in Montana for the past 2 years.

The wildcat is Atlantic's first strike in the Rocky Mountains.

Severance Tax Opposed

CASPER, Wyo.—Wyoming's oil and gas industry has been assured by Gov. Milward L. Simpson that he will oppose any efforts to impose a severance tax on oil and other minerals in the state.

"We don't need that kind of revenue in Wyoming," he told nearly 200 members of the Rocky Mountain Oil and Gas Association at the group's midyear meeting here.

"What we need is development," he added, "and a prohibitive tax structure does not lend incentive to development."

Harold H. Healy, Casper attorney and former division manager for Ohio Oil Co., was installed as new president of the association. He succeeded W. W. Flenniken, Denver.

Other officers are J. L. Dougan, Salt Lake City, vice president for Utah and Idaho; T. H. Hammett, Denver, vice president for Colorado and Nebraska; and William H. Curty, Casper, vice president for Wyoming and South Dakota.

Montana Sets Lease Sale

HELENA, Mont.—The first major auction of oil and gas leases on Montana school lands in 30 months is scheduled at the State Capitol here July 11 and 12.

A total of 178 tracts comprising 80,503 acres will be offered for the first time under the long-disputed 1953 indefinite-term law which grants leases of 10 years or as long as there is commercial production. The previous law limited leases to 20 years, after which time the acreage was again auctioned to the highest bidder.

The Montana Land Board has received applications from more than 175 bidders.

The board will demand a 16⅔ per cent royalty on four Fallon County tracts including 1,280 acres in or adjacent to the Fertile Prairie field.

This raises the possibility of a court test. A 1951 law states that only 12½ per cent royalty is required on the first 3,000 bbl. of oil a month.

Gas Injection Project Pays

SIDNEY, Neb.—Ohio Oil Co. and the Chicago Corp. expect a big payout from a $250,000 conservation project in Doran Farms field west of here.

They began last March 1 reinjecting into the pool the million cubic feet of natural gas produced daily with oil. By the end of August they expect gas cap pressure to reach the point recorded when the field was opened by Chicago Corp. in 1952.

Recovery of approximately 2 million barrels of oil which would otherwise be lost also is anticipated.

The gas is piped to Huntsman, Neb., for processing, then returned for injection through a well located directly on top of the gas cap. In addition to the million cubic feet of field gas reinjected daily, 5 million more cubic feet of purchased gas is being used.

The two firms voluntarily undertook the project to prolong life of the field after engineers warned that gas pressure was falling dangerously low. Nebraska has no gas and oil conservation laws.

New Williston Pay Indicated

DENVER.—Shell Oil Co. has an indicated new-pay discovery for the Williston basin at its Pennel area wildcat on the Cedar Creek anticline in eastern Montana.

The 22-X-36 State, in Fallon County, recovered 3,215 ft. of mud-cut oil on a drill-stem test in the lower Mississippian at 7,917-62 ft. There is no such production in the basin except for a stray sand at Sanish field in North Dakota. There have been showings in the basin from Lodgepole and Bakken sands, but no commercial strikes.

Two deeper tests were made, with a show of muddy oil at 8,149-8,249 ft. The operator is coring below 8,249 ft.

The Shell well, 9 miles southeast of Cabin Creek, is located inside Cedar Creek gas field. The well is also an apparent Mission Canyon discovery. Red River-Ordovician will be tested before completion is attempted.

FPC Examiners Split

One examiner opposes earlier ruling, claims commission has no right to regulate wellhead sales of natural gas

WASHINGTON.—Federal Power Commission examiners are split over whether wellhead sales of natural gas are exempt from regulation under the Supreme Court decision in the Phillips case.

Examiner Edward B. Marsh in April said they are not exempt. He held in the Deep South case that any sale of gas that eventually gets into an interstate pipeline is a sale in interstate commerce *(The Oil and Gas Journal, April 11, page 87)*.

Last week, Examiner Ewing G. Simpson took an opposing view. He said Congress never intended to regulate wellhead sales. He backed up his statement by recommending that the FPC dismiss the applications of 20 producers for sales certificates for want of jurisdiction.

Argument for control . . . In the case before Marsh, Shell Oil Co., Deep South Oil Co., and Humble Oil & Refining Co. asked the FPC to rule that their sales are not subject to regulation. He held that sales by independent producers prior to the completion of production and gathering are not exempt where the gas eventually goes into an interstate pipeline. Regardless of whether the sales are made before or after delivery to the pipeline.

The Deep South case was generally considered a test of producers' status. It was seen as providing a determination whether wellhead sales are covered by the Phillips decision. The FPC held oral argument on Marsh's decision last week and now has it under study.

Argument against control . . . Simpson's decision went to the commission the day after it heard the Deep South case. It involved applications for sales certificates filed by 20 independent producers, one of them Humble, in the Gwinville field of Mississippi.

The producers in the field have pooled their interests into field production units which are operated by Humble, Superior Oil Co., and Hunt Oil Co. The gas is sold to Southern Natural Gas Co.

Humble asked permission to continue to sell some of the gas to Southern. The other 19 producers apparently didn't like the deal. They asked permission to sell to the Gwin Co. for resale to the Dixie Pipe Line Co., which in turn would sell to the Transcontinental Gas Pipe Line Co. They also asked authority to abandon service to Southern.

In the case of the 19 producers, Simpson said they didn't come under FPC control because the right to "take in kind" is not subject to the provisions of Section 7(B) of the Natural Gas Act. Their application for permission to abandon service should be dismissed, he told the commission.

In the case of Humble, Simpson said that after review of the legislative history of the gas act the "conclusion is inescapable that Congress did not intend to regulate the wellhead, lease, or field-unit sale of natural gas, the legislative history of the act and the amendment of Section 7(C) thereof convincingly demonstrating that at least the certificate provisions of the act do not apply to such sales." He held the certificate applications of all 20 producers should be dismissed.

Simpson declared his decision is not in conflict with the Phillips case. He said, in effect, there can be no flat application of the court's ruling. The court held only that Phillips actually sold wholesale in interstate commerce for resale and such sales are neither a part of production or gathering or an exempt incident thereof. In other cases, he indicated, status decisions would have to be based upon the facts presented.

Simpson's decision is subject to review by the FPC. If there are no objections, it will become final in 30 days. In view of the conflict with the Deep South case, however, it is expected the commission will call for oral argument.

El Paso Looping Submitted

WASHINGTON.—El Paso Natural Gas Co. estimates its proposed big-inch looping program from the San Juan basin to the West Coast will cost $185 million.

El Paso laid plans for the line before the Federal Power Commission recently along with two alternative plans. The $185-million project calls for a 34-in., 500-mile loop of the firm's 24 and 30-in. lines. The line would carry 500 million cubic feet of gas daily south from Durango, Colo., to the California-Arizona border. Another 50 million cubic feet would move westward through existing lines.

The big looping program is part of a plan to expand El Paso's capacity 550 million cubic feet daily. California would get 450 million cubic feet of gas. The remainder would go to markets in Arizona, New Mexico, and West Texas *(The Oil and Gas Journal, May 23, page 83)*. It ties in with revised plans made by Pacific Northwest Pipe Line Corp. and Westcoast Transmission Co., Ltd.

Atom No Oil Threat

Both needed to fill energy demand, congressman says

WASHINGTON. — Development of atomic power will not hurt the oil industry.

Rep. W. Sterling Cole of New York, a member of the joint congressional committee on atomic energy who is in close touch with the work and research of the Atomic Energy Commission, says atomic power will take a slice of the energy pie in years to come. But the pie itself will be much bigger.

Twenty years from now, half of the new generating capacity built each year will run on atomic fuels, Cole said. By 1985 fully a quarter of all the electric power generated will be produced in reactors.

But in 1985 it is estimated the amount of electrical energy we will have to secure from conventional fuel sources will be six times as great as all the power generated today.

Cole said that a single pound of uranium-235 holds the energy equivalent of 200,000 gal. of petroleum weighing about 1,500,000 lb. But the job of transforming this atomic energy potential into useful heat is complicated and expensive.

In many areas it just won't pay to substitute atomic power. In some areas, where small rural generating stations run on diesel fuel, it may be cheaper some time in the future to put in small package atomic power plants.

Talking about the atomic-power situation recently before the Pennsylvania Grade Crude Oil Association, Cole suggested that the oil industry take every advantage of the new tools coming from atomic research.

Radioactive tracers already have been found valuable in multiproduct pipelines and in acidizing oil wells. Other uses also may be developed, he said.

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Rubber Profits U.S.

Sale of 25 plants will net $10,000,000, Congress told

WASHINGTON. — The Government stands to make a little money out of the synthetic-rubber industry it is now liquidating.

The three members of the Rubber Producing Facilities Disposal Commission drove hard bargains with buyers of the rubber plants. The Government will show a profit of $10,000,000 from the sale of 25 plants, they told Congress last week.

In addition, the commission is making headway on talks with 11 bidders for 447 pressure tank cars valued at $1,000,000. And it still has two plants, a laboratory, and some equipment with a book value of $13,435,000.

One of the plants, a butadiene producer at Louisville, Ky., has been leased for $1,000 a month and $6 per ton of production. If it operates anywhere near its 87,000-ton capacity, it could bring in almost $500,000 a year.

Twenty-four of the plants already have been transferred to private owners. Sale of the GR-S plant at Baytown, Tex., is expected to go through shortly. It is now before Congress for approval.

The net book value of all plants and other assets in the Government's synthetic-rubber program was estimated by the commission at $128,088,000. The operating deficit since the start of the program in 1942 was $132,700,000.

This made $260,788,000 the commission wanted to recover for the Government. It got $270,796,000. Cash on hand from the revolving fund, inventories, spare parts, finished rubber, and plant additions sold add another $145,000,000. A total of $415,000,000 will go into the Treasury.

The men responsible for the sales are experienced businessmen. Holman D. Pettibone, chairman of the commission, is chairman of the board of the Chicago Title & Trust Co. Other members are Everett R. Cook, president of Cook & Co., Memphis, Tenn., and Leslie R. Rounds, retired first vice president of the Federal Reserve Bank of New York.

While the Government stands to make money on the plants it is selling, it probably has taken a loss on the rubber program as a whole. The commission got 27 plants to dispose of, but the Government built 51 at a cost of $700,000,000.

Fourteen were disposed of at a loss after the war. None, however, was sold for private production of general-purpose synthetic rubber.

WATCHING WASHINGTON

Bertram F. Linz

School for Industrialists

Oil supply, military procurement, plant protection and manpower are among the 32 subjects to be covered in the 1955-56 national resources conferences of the Industrial College of the Armed Forces.

Oil men are being invited to attend the 2-week sessions which will begin in September and run until next May. They will be held in 16 cities, several of them in the oil-producing areas.

The idea back of the courses is to give industrialists the military view of the world situation and how it affects our security. They cover the national resources which are the basis of our security and position in world affairs. But the teaching is purely informative. No effort is made to sell any particular program, organization or plan.

These courses are the Defense Department's recognition that war is no longer purely a military matter. Actual war in one way or another affects every person, every dollar, every factory and every pound of material in the country. And even minimum preparations for national defense involve so many people, so much material and so much money that the entire economy is affected.

The conferences are sponsored by local chambers of commerce. Oil men wishing to attend should apply to the chamber of the city to which they wish to go. Among others, sessions will be held in Houston, Tex., September 19-30; Santa Barbara, Calif., October 17-28; Berkeley, Calif., January 23-February 3; Jackson, Miss., February 13-24; Shreveport, La., February 13-24, and Waco, Tex., March 12-23.

No Secret Settlements

The Department of Justice isn't going to make any out-of-court settlements of antitrust cases. It's going to put everything on the record. So any oil company that tangles with the department is going to get the unfavorable publicity that always goes with government suits.

Attorney General Brownell is willing to make agreements for consent decrees in advance of the filing of a case. But those agreements must go to the courts and be spread on the records.

Under the policy now followed by the department, companies charged with violations of the antitrust laws are advised that suit is to be brought. They are invited to talk it over with department officials. If an agreement is reached giving the Government substantially what it wants, it is put in the form of a consent decree. That decree is submitted to the court when the complaint is filed. If no agreement is reached, suit is brought and tried.

The main advantages of settlement by decree are the saving of the time and expense involved in court proceedings and a minimum of publicity which might be adverse to the defendants. The Government may get more or less in the way of relief than the courts would give. That is a chance the defendants have to take.

Wanta Build a Pipeline?

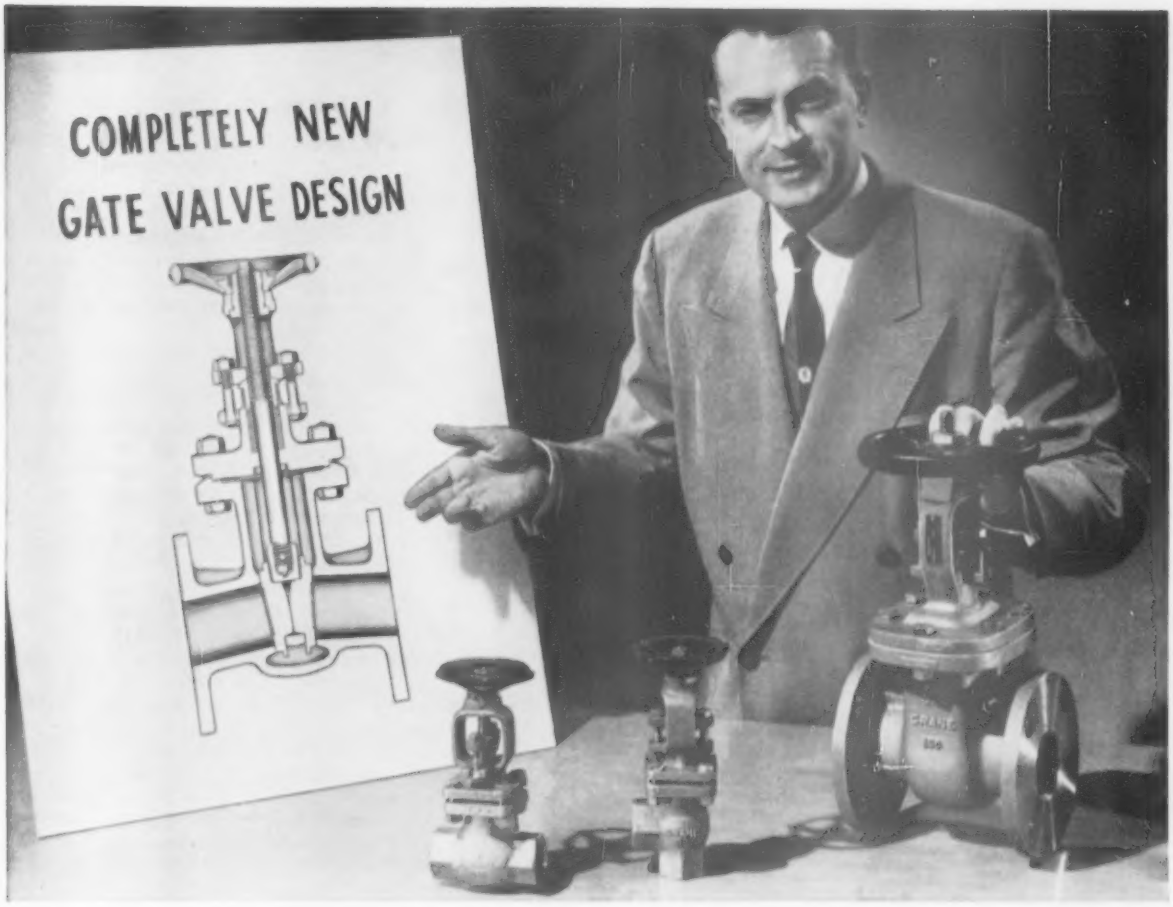
It takes a lot of things to make a natural-gas pipeline.

Take the Pacific Northwest Pipeline Corp.'s 1,466-mile line being built from the San Juan basin in New Mexico to the Pacific Northwest.

The main line and its branches will take 316,700 tons of steel. When it gets going at capacity it will need 92,400 hp. for compression of the gas. More than 18,000 M.c.f. of gas daily will be required to operate the compressors. Gas put into the line in New Mexico won't reach the northern terminal until a month later.

Just to fill the line to a pressure of 75 psi. will require about 2,000,000 M.c.f. of gas which will cost $200,000. Then to make sure that all is well along the line, the company will spend $1,100,000 for a private microwave communications system.

Pacific Northwest won't just run the pipeline. It will also run a lot of drilling operations for the companies which will supply the gas. These include Phillips Petroleum Co., Colorado Oil & Gas Corp., Sinclair Oil & Gas Co., Skelly Oil Co. and the Chicago Corp. Already, 117 wells have been completed, 7 are being drilled and 127 additional locations have been approved.



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Note, for instance, the unique yet simple split-wedge disc construction in the gate valves. Those dual identical discs are free to rotate in their holder—the most effective design for resisting galling. The trunnion shape at the back of each disc assures even distribution of closing forces. You couldn't buckle them if you tried.

The globe and angle valves give equally outstanding control of corrosive fluids. A new type disc-stem connection, with minimum clearances, practically eliminates vibration. By placing seating load closer to seats, it provides easier, more accurate closure.

Check valves feature compact, thoroughly proved, non-slamming design.

Throughout, these valves are built for better service in your choice of Crane 18-8 SMo Stainless Steel or Craneloy 20. Both lines come with screwed or flanged ends.

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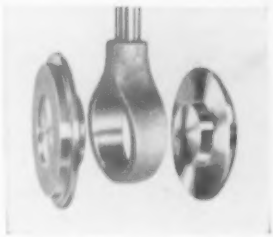

New split-wedge disc in gate valves combines the benefits of free rotation with uniform seat load pressure.

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CRANE'S FIRST CENTURY...1855-1955

Gas-Price Probe Asked

Harris declares producer isn't responsible for high consumer prices; transportation, distribution blamed

WASHINGTON—Rep. Oren Harris of Arkansas wants to show the country that the producer isn't the villian behind high consumer gas prices.

High consumer prices are due to conditions in transportation and distribution, Harris says. He has asked the House to let the interstate commerce committee investigate the matter and bring out the facts.

Harris wrote the bill to exempt producers from Federal Power Commission regulation. During hearings before the committee the bill was attacked repeatedly as an attempted steal by the big oil companies.

Those charges got wide publicity in the consuming areas. Very little publicity was given the fact that the field price of gas is only a fraction of the consumer price.

The public is confused, Harris said. So is Congress. That was shown in the one-vote margin by which the bill was sent to the House floor. It was shown, too, by the amendments which give the FPC a measure of "back-door" control of producer rates through regulation of prices to be paid by the pipelines.

The field price of gas averages around 10 per cent of what the consumer pays, Harris pointed out. The spotlight should be turned on the real source of high consumer prices, which is in transportation and distribution, he said.

What needs checking . . . Harris listed a number of factors which he said should be investigated. Interlocking directorates, holding companies, and investment trusts may have an influence on price. The FPC has called for a study and has suggested federal control over such arrangements, he pointed out.

Harris said the interstate commerce committee should find out if transportation is costly because of interlocking relationships among various companies.

"Is it because of certain types of management and operation?" he asked. "Is it because outmoded, obsolete equipment is being carried as indicated in one case at several million dollars, included in the rate charged to the public?

"Is it because of holding-company operations, as it is with one company which has several of the largest distributing subsidiaries in the East and North?

"Or is it because one affiliate of a company is selling to another, then another before it ever gets to the consumer?

"Let us see who is calling the kettle black," Harris told the House. "Let us find out who is making fabulous profits before taxes. Let us find out actually where legislation may be necessary to adequately protect the consumer."

ICC Eyes Oil Flow

At issue: Will intrastate truck lines be regulated?

WASHINGTON.—The Interstate Commerce Commission is surveying the line between the interstate and intrastate movement of oil.

The ICC must decide whether interstate transportation ends when oil from outside reaches pipeline or marine terminals in a state, or whether the movement of oil by truck from those terminals to points within the state is still in the interstate stream. Its answer will determine whether intrastate truckers are to be brought under federal supervision.

The commission has not indicated that it wants this job of regulation. But the point was raised and the ICC had to take a position. It held hearings on the matter last week.

The American Petroleum Institute told the ICC there is no need for federal regulation of intrastate truck transportation. A. G. Anderson of Socony Mobil Oil Co., chairman of the A.P.I. committee on law and regulation, told ICC Examiner Brady that truckers who pick up and deliver oil without crossing state lines are definitely engaged in intrastate commerce.

Oil-company witnesses and representatives of nearly 30 states also protested ICC control of what has always been regarded as intrastate commerce. Every state except New Jersey has laws and regulations governing this movement, it was pointed out.

Pipeline companies, which are not directly involved, offered some important facts. They said that when oil is received they do not know what its ultimate destination will be. So far as they are concerned, transportation ends at the pipeline terminal. There the oil goes into tanks and may be held for several weeks.

Imports Cut Urged

I.P.A.A. wants immediate action to reduce oil flow

WASHINGTON.—Immediate action to reduce oil imports was demanded last week by Russell B. Brown, general counsel of the Independent Petroleum Association of America.

If the importing companies do not immediately reduce their takings of foreign oil, the President should order limitations under the new Reciprocal Act, Brown said in a report to his members.

Crude imports during the first quarter of this year were 13.4 per cent above the average for 1954, Brown said. Product imports were 28.6 per cent higher. For the current quarter indications are that crude imports will be 12 per cent above last year and products up 16.5. Programs of the importing companies, as given the Texas Railroad Commission, indicate that third-quarter crude imports will be up 14.5 per cent and products 14.8 per cent over 1954, Brown said.

These imports are "significantly" above the levels recommended by the cabinet fuels committee, Brown pointed out. And, he said, "since the Senate and House have passed legislation aimed at implementing these recommendations, the increased volume of imports is also violating the expressed wishes of the Congress."

Brown said some importing companies are taking steps to keep entries at their 1954 level. But total imports remain excessively high. If the companies don't get them down, he declared, "they can no longer complain at such action as may be necessary to bring about a proper recognition of the responsibility they must assume."

Gas Bill Slowed

Free market or controls? Future remains uncertain

WASHINGTON.—The drive for exemption of natural-gas producers from federal price control slowed down to a walk last week.

The House interstate commerce committee was writing majority and minority reports on the Harris bill, which earlier it approved by a close 16-15 vote. The Senate interstate commerce committee has wound up its hearings but has had no meetings to discuss the bill. Sen. J. W. Fulbright of Arkansas is the sponsor in the upper chamber.

There is considerable uncertainty over when the bill will be taken up

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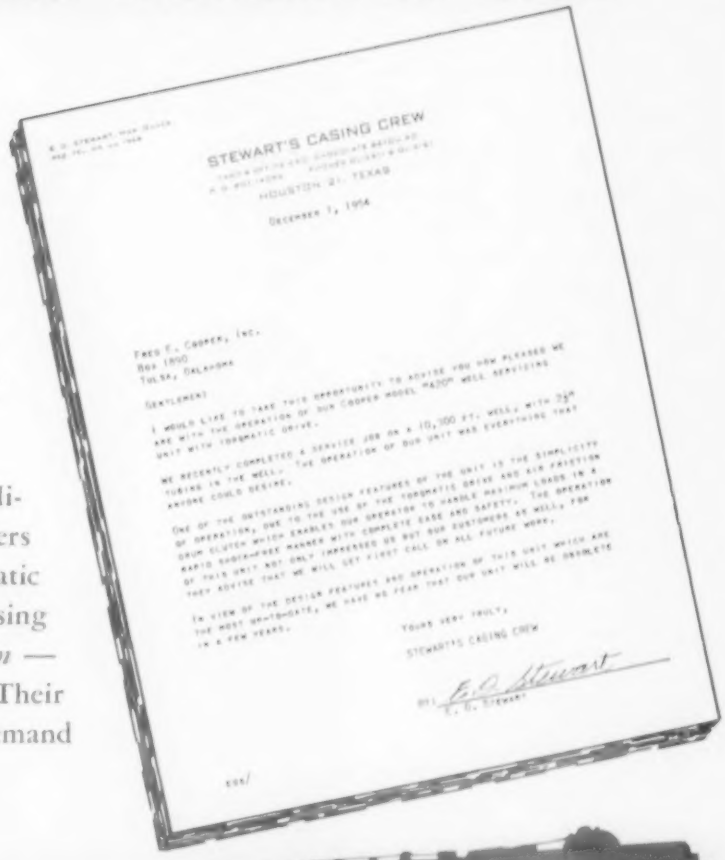
WHAT DO THE OPERATORS SAY?

Read what Mr. E. O. Stewart thinks of the COOPER "420".

Stewart's casing crew, a highly successful contracting organization operating in the Houston area, has been in the business many years. They know their business and they know machinery.

This is only one of many complimentary reports received from owners and operators of Cooper Torqmatic Units. Every one of them stressing *Easy, simple shock-free operation — Speed, safety and modern design.* Their customers request and sometimes demand Cooper Torqmatic Drive Rigs.



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December 7, 1954

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Gentlemen:

I would like to take this opportunity to advise you how pleased we are with the operation of our Cooper Model 420DH Mast Servicing Unit with Torqmatic drive.

We recently completed a service job on a 10,100 ft. well with 2⅞" tubing in the well. The operation of our unit was everything that anyone could desire.

One of the outstanding design features of the unit is the simplicity of operation, due to the use of the Torqmatic drive and air friction drum clutch which enables our operator to handle maximum loads in a rapid shockfree manner with complete ease and safety. The operation of this unit not only impressed us but our customers as well, for they advise that we will get first call on all future work.

In view of the design features and operation of this unit which are the most outstanding, we have no fear that our unit will be obsolete in a few years.

Yours very truly,
STEWART'S CASING CREW
By: E. O. Stewart
E. O. Stewart

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Why not let a Cooper Sales Engineer give you full details, or better yet see one in operation and then talk to the "man that owns one".

Owners of modern, Torqmatic Drive Rigs get "first call" for those deep wells that require the best of equipment.

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by the House. Chairman J. Percy Priest of Tennessee said the committee's report might be submitted this week. But he said he was leaving it to the House leadership to decide when the bill should be brought up.

Whether the bill will get through the House and in what form is still a matter of speculation. Gas producers and pipeline operators are not satisfied with it as voted out by the committee, but are willing to go along. Consumer interests are still attacking it, and it is from this angle that the bill is in most danger.

But opposition to the bill may be reduced by Rep. Oren Harris' demand for a full investigation of transportation and distribution costs. Such a study, Harris declared, would show that high consumer rates are due to pipeline and local distributing companies, not to producers' prices.

In the face of undeniable evidence that the producers' prices are 10 per cent or less of the consumers' rates, consumer representatives might well support an investigation.

No further action on the legislation is expected in the Senate until the House votes on the Harris bill. Sen. Lyndon Johnson, of Texas, Democratic leader, is believed to have enough votes available to pass a bill if it comes over from the House.

But if the House turned the measure down, there would be no point in Senate action. So the word, apparently, is "wait and see."

GULF COAST

Gulf Field Found

Second discovery recorded by Magnolia in 2 weeks

MORGAN CITY, La.—Magnolia Petroleum Co. last week uncovered another new field in the Gulf of Mexico off the coast of Louisiana. It was the company's second offshore discovery in as many weeks.

The new discovery is in Block 128, Eugene Island area, 30 miles from St. Mary Parish. Initial flow was 132 bbl. of 39.5°-gravity oil per day through 3/16-in. choke with a gas-oil ratio of 1,141 cu. ft. per barrel.

Production is from a Miocene sand, perforated at 10,110-16 ft.

The location is 7 miles west of the company's large, multiple-pay Block 126 field.

The week before Magnolia opened another field 45 miles southeastward in Block 113, Ship Shoal area, 20 miles off Terrebonne Parish. The discovery well produced gas and condensate from sand at 10,298-10,304 ft.

The company has started testing its second well with oil production from a shallower sand, perforated at 7,470-76 ft. Initial flow was at the rate of 73.78 bbl. of 33.9°-gravity oil per day through 3/16-in. choke.

Zapata Adds to Fleet

HOUSTON.—Zapata Offshore Co. has bought a 2,400-ton tender from Standard Oil Co. of Texas for use in tidelands drilling in the Gulf of Mexico.

The 260-ft. vessel, now being converted at Hunt Tool Co.'s marine yard at Harvey, La., will be used in contract drilling for Standard of Texas. Zapata also has acquired a 16,000-ft. rig for use on stationary platforms in the gulf, and has ordered a self-contained drilling platform which is now being constructed by R. G. LeTourneau, Inc., at Vicksburg, Miss.

Kleberg Test Hits

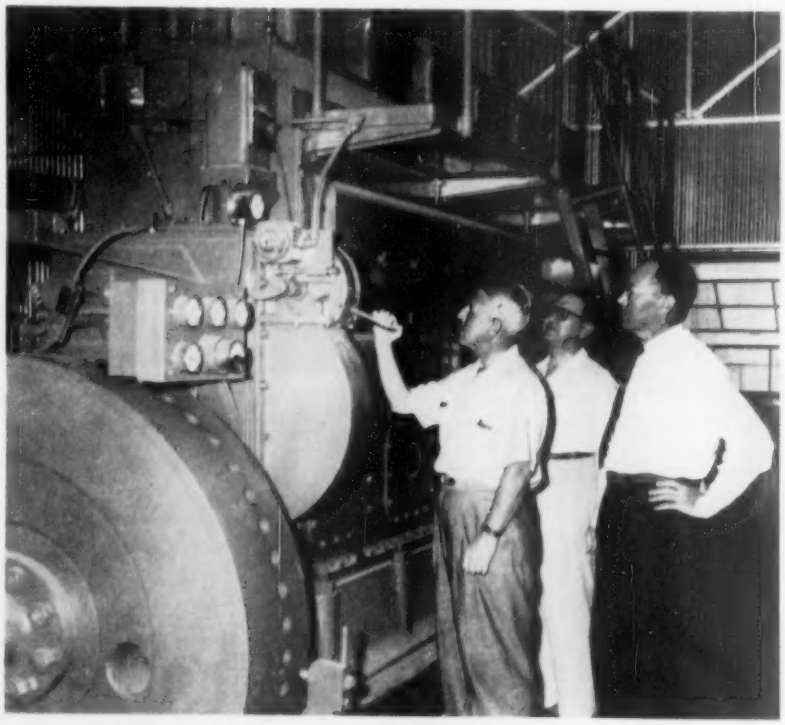
Arkansas Fuel's wildcat is in heart of big King ranch

KINGSVILLE, Tex.—What appears to be one of the best oil discoveries this year in the lower coastal region of Texas was made last week by Arkansas Fuel Oil Corp. in southern Kleberg County.

The discovery well, 1 May, is in the Gabriel Trevino Survey, 18 miles southeast of here, in the heart of the vast King ranch country. It came in flowing at the rate of 10 bbl. of 30.8°-gravity oil per hour from a Frio sand, perforated at 9,350-62 ft.

Location is 3 miles north of the Kenedy County line. It is 4 miles north of Riviera Beach field, nearest production in that sparsely drilled part of the lower coastal region.

Arkansas Fuel Oil Corp. owns a 4,200-acre block of leases around the discovery.



Injection Started in Big Unit

Another big pressure-maintenance program started in West Texas' Canyon Reef pay when the first water was injected into the Sharon Ridge Canyon unit of Scurry and Borden counties. D. L. Connelly, vice president of Warren Petroleum Corp., pulls a lever on a 725-hp. engine starting the injection at Snyder. J. Roy Auers, unit manager, and H. F. Beardmore, production manager, look on. Warren is unit operator. The project includes 343 wells on 13,873 acres. Water will be injected into 19 wells. Initial input will be 15,000 bbl. daily, but will be increased to 35,000 bbl. daily July 1 when the number of input wells is jumped to 35. The water is being injected at approximately 6,800 ft. An additional 109 million barrels of oil is expected to be recovered as result of the program. Earlier this month another big unit was reported in the Scurry County area. This latest unit—fifth for the area—was approved in Cogdell field, which straddles the Scurry-Kent County line **(See page 61).**

Trinidad Tax Showdown

British firms threaten to end offshore oil hunt unless they get depletion allowances; government expected to comply

THE Trinidad Government soon may grant tax concessions for marine drilling after three British oil companies officially threatened to withdraw from the country.

The companies, operating under the name Trinidad-Northern Areas, Ltd., are British Petroleum Co., Ltd., United British Oilfields of Trinidad, Ltd., and Trinidad Leaseholds, Ltd. They told the government that without tax concessions their joint efforts to find new marine sources of oil would be in jeopardy.

A statement by T. N. A. notified the government that plans for further development work cannot be made final until applications for a percentage depletion allowance for marine operations are decided upon.

Uncertain well . . . T. N. A. spudded the island's first offshore well last July. It is located 6 miles from Cedros Point off the southwest corner of Trinidad. The well was located 7.51 miles back of the international boundary between Venezuela and Trinidad in the Gulf of Paria, and is 14.34 miles from the Point Fortin jetty lights. To date, the operation has cost about $2,200,000. The only discovery announced so far has been a "Trinidad-type well."

The statement amplified earlier press reports that this well was producing about 160 bbl. daily. The water-oil ratio has increased to the point where sands under test became almost entirely water-flooded and were abandoned. Some water-free oil is being obtained from sand tested at a higher level. But tests have not yet determined how well the horizon will stand up to production.

The report emphasized that this type production is inadequate to constitute a paying prospect for a new high-seas well, where costs are several times greater than on land. Moreover, reliable evidence of general regional prospects cannot be expected from one well only.

Big investment . . . In reply to the tax warning, government leaders stated unofficially that Trinidad's executive council, or cabinet, recently approved in principle a percentage depletion allowance for marine drilling operations. The council further agreed that the percentage should be worked out in consultation with the oil companies.

T. N. A. chairman, J. B. Christian, had stressed the need for a depletion allowance at the spudding-in ceremony of the marine well last year. He said tax considerations were needed for Trinidad's oil industry as a whole and for marine operations in particular, where costs are higher.

He had emphasized that in Trinidad the ratio of crude oil offtake to established reserves was not satisfactory, and without new reserves soon, the industry likely would enter an early phase of terminal decline.

T. N. A. spent about $5,000,000, exclusive of the marine well, in an unsuccessful exploration program in Trinidad beginning in 1936. Survey work for the offshore operation began in 1945. Gravity work in 1947, and seismographic study in 1952. U.B.O.T. (Royal Dutch-Shell) is carrying out T. N. A.'s marine operations (*The Oil and Gas Journal, July 19, 1954, page 84*).

Craters Burn Out

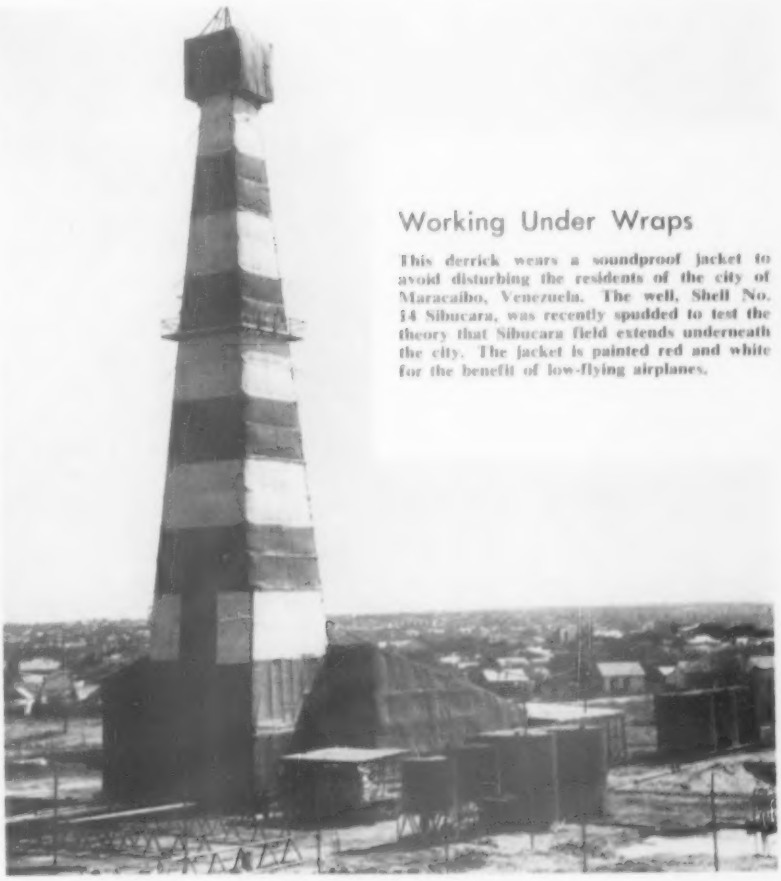
Repairs being rushed at East Pakistan discovery

PLANS are under way in East Pakistan to resume work at the Sylhet No. 1 discovery well after costly crater fires finally had burned themselves out.

Pakistan Petroleum, Ltd., officials said they were sparing no effort to restore normal operations. The Indian Government has granted permission to transport equipment to Sylhet from Assam Oil Co.'s Digboi field about 300 miles northeast.

The test well blew out in several places 200 to 300 yards from the rig 3 days after casing was cemented.

Fires from two burning craters damaged drilling equipment and destroyed several camp buildings. Flames at their



Working Under Wraps

This derrick wears a soundproof jacket to avoid disturbing the residents of the city of Maracaibo, Venezuela. The well, Shell No. 14 Sibucara, was recently spudded to test the theory that Sibucara field extends underneath the city. The jacket is painted red and white for the benefit of low-flying airplanes.

peak leaped 400 ft., Myron Kinley, Houston, Tex., oil well fire fighting expert, flew to the scene but now has returned to the United States.

Much of the drilling equipment and property was saved by efforts of employes and local authorities. Officials reported that wellhead equipment and fittings far exceeded expectations in standing up to high pressures and rigorous conditions.

The well is in the northeastern corner of the country at Haripur, 13 miles from Sylhet town. It was located on an anticline on the basis of seismographic study. Evidence of gas was found at 7,800 ft. and casing was cemented at 7,727 ft. Color of the burning gas indicated it was charged with oil. East Pakistan has no oil production *(The Oil and Gas Journal, June 13, page 145).*

Iran Backs Consortium

Press charges of economic imperialism are false, NIOC says; attacks blamed on either ignorance or sabotage

MORTEZA GHOLI BAYATT, managing director of National Iranian Oil Co., has spiked rumors that Iran is under pressure to sell its share of crude production to the consortium.

Bayatt denied local press reports that the consortium had warned independent foreign companies against buying Iran's share. There is no difficulty either in obtaining the 12½ per cent of the oil belonging to Iran or in utilizing it, he said.

The denial was made in the face of press criticism accusing the consortium of "economic imperialism." Such rumors spring from ignorance or sabotage, the NIOC manager said. He added that the consortium has acted fully in the spirit of the agreement signed last year. In some cases, it has given concessions to NIOC, beyond the requirement of the agreement, in the sale of refined oil.

The rumors point up a dilemma faced by NIOC: whether to take its 12½ per cent share of production in crude or in cash. This will amount to about 40,000 bbl. daily this year.

Iran has the right to market its 12½ per cent of production, but it would lose money it if did so. The government would have to bear part, or all, of the freight and marketing costs. If Iran's share is sold to the consortium, the country would receive top world prices. Since Iran's current budget deficit is about $70,000,000, there is reason to cut losses by giving up the attempt to market its crude.

Agitation threatened . . . On the other hand, if NIOC does sell its crude to the consortium, there is risk of political agitation within Iran. Lack of developed markets was a major cause of failure when the Mossadegh government nationalized the industry in 1951.

Bayatt said selling crude at a loss is justified only if NIOC secures a permanent market for its oil and has some control over transportation and distribution. When NIOC receives any offer for crude, it must decide whether the purchaser's distribution facilities in the world market would offset the lower price.

Meanwhile, Iran has informed Japan and Italy that it is unwilling to barter oil for products unless the products are competitive on world markets.

Japanese and Italian importers have been insisting on the same 50 per cent discount allowed them by Mossadegh immediately following nationalization. Negotiations have been under way between NIOC and individual firms from these countries, but no settlement has been made.

Israel Finds Gas

Oil traces also indicated in fire following blowout

AN Israel-American Oil Corp. test well 20 miles southwest of Petah Tiqva has made the most important gas strike in Israel to date.

Gas from Miocene sands at a depth of more than 3,018 ft. blew out and caught fire. Gas pressure estimated at 2,000 psi. lifted drill collars sufficiently to throw the slips and heavy drive bushings out of the rotary table.

Flames were more than 100 ft. high. The fire burned out in half an hour. Red and yellow flames indicated there may have been traces of oil. There was no sign the well had blown any water.

Earlier shows of gas were encountered at 2,526 ft. and at 2,755 ft. Oil stains were found at intervals to 2,755 ft. In the course of drilling, the well encountered gummy clays and marls from about 590 ft. to 3,018 ft. Drilling is continuing to lower formations.

Israel-American Oil recently acquired from Nadel & Gussman and the Palestine Economic Corp. a 25 per cent interest in the Gan Vavne license on which the gas find was made. In the event of commercial production from the area the company may increase its interest to 50 per cent.

There are now eight licensees exploring for oil and gas in Israel.

International Briefs

The Greek Parliament has ratified the contract for construction of a 30,000-bbl. daily refinery at Aspropyrgos, near Athens. Hydrocarbon Mineralol, Gm.b.H., Dusseldorf, the German affiliate of Hydrocarbon Reasearch, Inc., will build the plant. It is to be completed in 2 years. Private firms interested in operating the refinery have been asked to submit applications showing technical and financial qualifications by June 30.

Red China has started exploration drilling in Tsai Dam basin in the northwestern province of Chinghai. Well sites were located on the basis of promising structures and oil seepages found in last year's surveys, the government said.

Cie. Raffinage Shell-Berre (Royal Dutch-Shell) has started construction of a 5,200-bbl. daily catalytic-cracking unit in its 50,000-bbl. refinery at Petit Couronne, near Rouen.

British Petroleum Co., Ltd.'s D'Arcy Exploration Co. has discovered oil at Egmanton, Nottinghamshire, England. A show of high-quality crude was found by a wildcat at about 3,200 ft. in the same horizon yielding oil in Eakring, the company's field 6 miles to the south.

Oil-shale deposits in northern Thailand (Siam) are to be developed by Thai Coal & Oil Co., Ltd., a local firm. Shale samples analyzed by the U. S. Bureau of Mines showed 25 per cent crude-oil content. Deposits are estimated at more than a million tons. German equipment and technical skill will be used in the project.

British Petroleum Co., Ltd., has placed on stream its sixth Platformer, a 6,000-bbl. daily unit at its Llandarcy, South Wales, refinery. The unit produces 90-octane blending component from naphthas derived from Iranian or Kuwait crude. Other Platformers are on stream at BP group refineries on the Isle of Grain, England; Aden; Lavera, France; and Hamburg, Germany. A seventh unit is under construction at the Porto Marghera refinery near Venice.

Because of this part . . .

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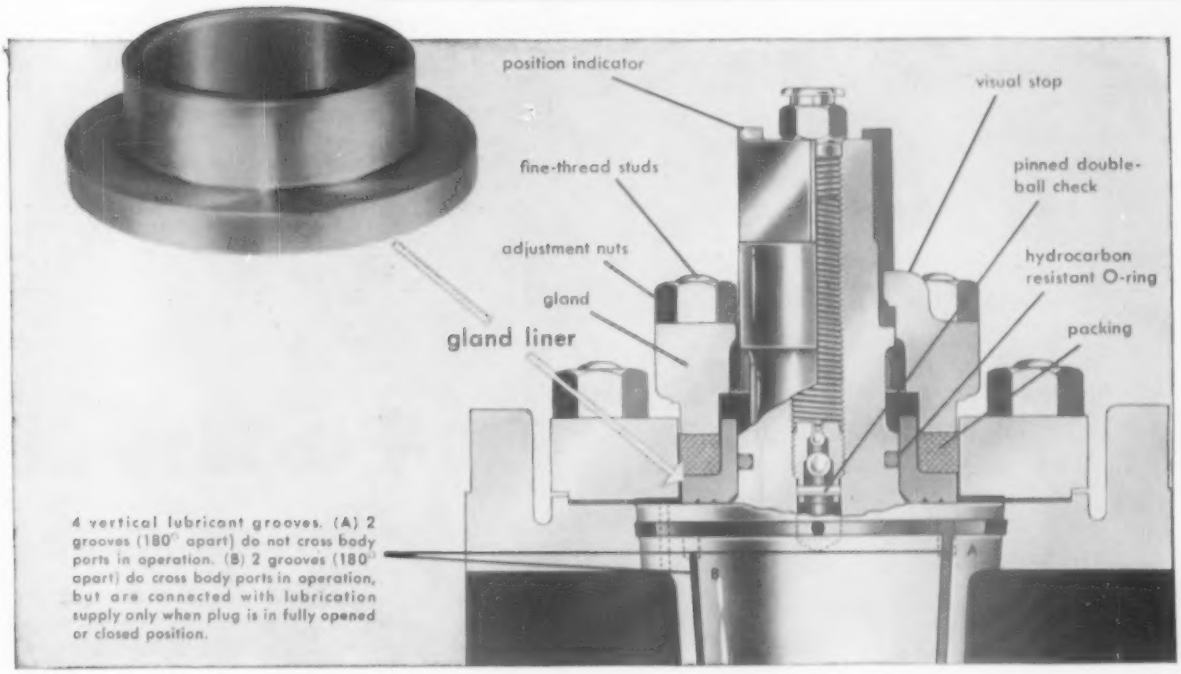
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4 vertical lubricant grooves. (A) 2 grooves (180° apart) do not cross body ports in operation. (B) 2 grooves (180° apart) do cross body ports in operation, but are connected with lubrication supply only when plug is in fully opened or closed position.

It's the gland liner . . . versatile component of the newly designed OIC Lubricated Plug Valve. It seals, reduces friction, helps extend packing life.

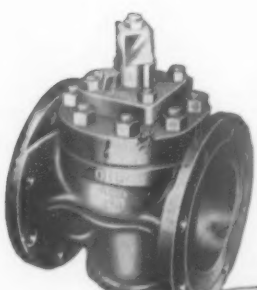
This liner forms an additional seal where its mating surfaces are lapped to the top of the plug. Machined from a special bronze—OIC Alloy 40—it has extremely low friction bearing characteristics, helping to make this valve easy to operate. It will not gall or seize.

Note in the cutaway illustration that this gland liner completes isolation of the resilient packing from all rotating parts. The packing is not subjected to undue wear, therefore, insuring proper plug loading without need for frequent gland adjustment.

Fine threads on the studs permit precise adjustment of the gland, further contributing to ease of operation and proper seating of the plug in the valve body.

Write for Bulletin 1003 giving complete data on this new OIC Lubricated Plug Valve design. Available in steel, 150 and 300-lb. pressure classes, sizes ½" to 12".

Order through your OIC Distributor.



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Oxygenated Chemicals—Why?

What makes the oxidation route an attractive one for upgrading hydrocarbons into chemicals?

. . . **1. Low cost.** This is the chief advantage of hydrocarbon oxidation processes. In a time of more intense competition such as we are now entering only the most economical process can survive.

. . . **2. Flexibility.** Oxidation processes produce several basic chemicals from which a host of other chemicals can be made. This provides plenty of room for diversification and integration.

. . . **3. Process improvements.** Recent process developments make it possible to vary relative yields of the different oxidation products by as much as 25 per cent. This provides enough flexibility to meet any market shift. But the market for these chemicals is so great that it will even sustain a fixed yield ratio in any one given operation.

. . . **4. High purity.** Early operation of first commercial units led to the belief that oxidation chemicals were of low quality. In the past several years their quality has been greatly improved. The high-purity oxidation products are now accepted by all consumers without any prejudice whatsoever.

OTHER ARTICLES

Articles to follow in this new Journal petrochemical series will cover:

. . . **Economics of oxidation processes.** Comparative costs and cost factors in ethane, propane, or butane to the primary oxidation products—acetaldehyde, formaldehyde and methanol.

. . . **Conversion of intermediates.** Different routes for making end products from the primary oxidation products and their economics.

. . . **Oxidation with pure oxygen.** Meyer process described in more detail.

Other subjects will be announced later.

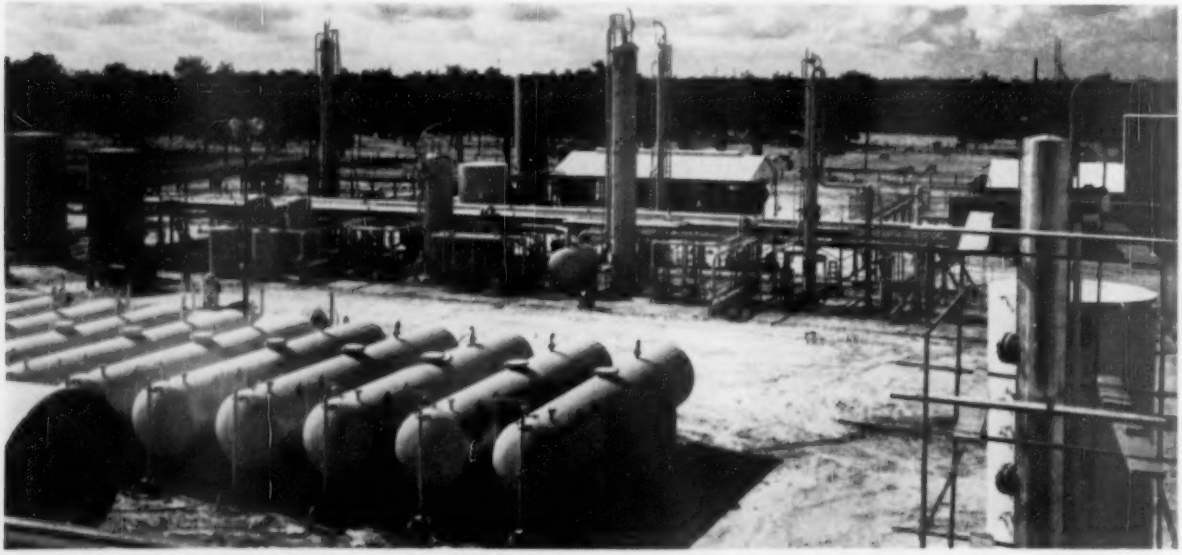
UPGRADING HYDROCARBONS BY OXIDATION—1

L.P.G. to Chemicals . . . by Oxidation

by Dr. Ronald E. Meyer

SINCE World War II both propane and butane have become abundant and cheap. Catalytic cracking processes produce substantial quantities of propane and butane; also the various state governments have enforced strict conservation controls against waste of petroleum products by flaring of gas. Propane and butane have been surplus commodities for several years. The surplus has been taken care of by installing underground storage facilities. However, production has become so great that even during the peak consuming winter periods it has become increasingly difficult to deplete this storage to any extent.

Butane was the first to encounter rough sledding. It started about 3 years ago and was first felt in the West Texas area where the price of butane dropped well below 2 cents per gallon for extended periods. Propane did not encounter much trouble until last January when a rash of price cutting among the marketers sent the price skidding from 4 cents per gallon to the present price of 2 cents per gallon, with some distress material selling for as low as ½ cent per gallon. This is only a temporary situation, however, and propane is soon expected to resume its normal price structure of 3 cents per gallon.



New petrochemical plant at Conroe, Tex., employs pure oxygen to oxidize propane. Pentaerythritol is major end product.

1. OXYGENATED CHEMICALS

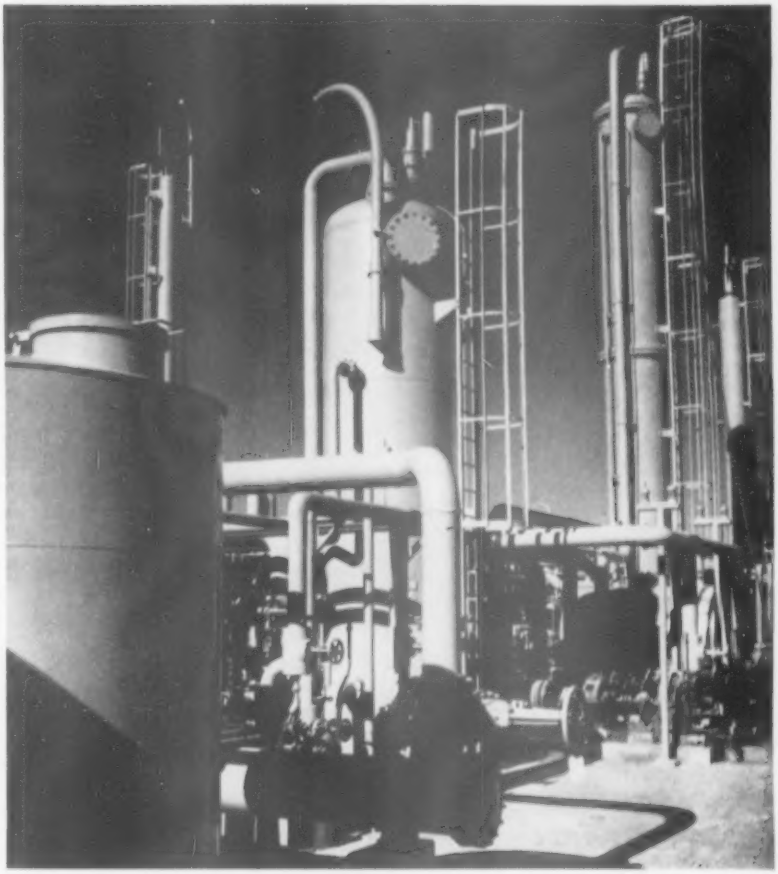
One way to eliminate surplus propane and butane supplies is to find new uses for them. The direct oxidation of these hydrocarbons into oxygenated chemicals appear to be very favorable at this time.

High purity . . . Hydrocarbon oxidation processes have been investigated for over 30 years. Many patents have been obtained on them. All of the basic patents were issued in the early 1930's and have since expired. The last one expired about 2 years ago. While the processes have been known for a long time, it has been only recently that the technology for the separation and purification of the chemicals produced has been developed sufficiently so that they will meet the rigid specifications for the same chemicals when produced by the conventional processes, and are now definitely able to withstand competition. In fact this purification technology has been developed to such a degree that all of the chemicals made by oxidation are of better quality than those made by competitive processes.

How oxidation started . . . In the late 1920's and early 1930's the markets for propane and butane had not yet been developed. There was a limited use for butane as a constituent of natural gasoline but no outlet whatsoever for propane. Most of these hydrocarbons were disposed of by allowing them to weather off into the air. These circumstances initiated a major research effort on the part of the petroleum industry. The result was the issuance of numerous patents on the oxidation of gaseous hydrocarbons. Several processes were developed for the conversion of natural gas, propane, and butane into chemicals.

Cities Service . . . The two most important processes developed at that time resulted in the installation of a plant at Tallant, Okla., by Cities Service Co. and a semicommercial unit at Goodhope, La., by Hanlon-Buchanan Co. Both processes are similar in that they use air as the oxidizing medium and produce the same chemicals. But the similarity ends here since the Walker process used by Cities Service originally oxidized natural gas while the Hanlon process oxidized propane or butane. However, since butane became so abundant and cheap in 1953 and 1954 Cities Service converted its process to utilize butane instead of natural gas.

The Hanlon plant at Goodhope successfully produced chemicals from propane and butane but the venture was finally abandoned in 1933 because of: (1) difficulty in obtaining commercially satisfactory products from the reaction stream, (2) the acute financial stress of the national economy during the development period; and (3) discovery of other outlets for propane and butane.



Acetaldehyde, formaldehyde, and methanol are the major chemicals produced by hydrocarbon oxidation process. This is equipment at Conroe, Tex., petrochemical plant.

Celanese . . . A few years after the Goodhope plant was abandoned, Celanese Corp. took up where the others left off. During the favorable period of World War II, Celanese was able to go ahead and started production of oxygenated hydrocarbon chemicals at Bishop, Tex., in the summer of 1945.

Using oxygen . . . The end of World War II saw the advent of several new processes for the production of cheap tonnage oxygen. Recognizing the intriguing possibilities of this material, the author developed a new process for the use of oxygen in the oxidation of L.P. gas hydrocarbons which will be described later.

It is interesting to note that all of the processes developed to date for the production of chemicals from gaseous

TABLE 1—OXIDATION REACTIONS FOR PROPANE

$$C_3H_8 + O \rightarrow \underset{\text{Acetaldehyde}}{CH_3CHO} + CO_2 + H_2O$$

$$C_3H_8 + O \rightarrow \underset{\text{Methanol}}{CH_3OH} + \underset{\text{Formaldehyde}}{HCHO} + CO + H_2O$$

$$C_3H_8 + O \rightarrow \underset{\text{Formaldehyde}}{HCHO} + \underset{\text{Acetaldehyde}}{CH_3CHO} + CO + H_2O$$

$$C_3H_8 + O \rightarrow \underset{\text{Propionaldehyde}}{CH_3CH_2CHO} + H_2O$$

$$C_3H_8 + O \rightarrow \underset{\text{Ethylene}}{CH_2{=}CH_2} + \underset{\text{Methanol}}{CH_3OH} + CO + H_2O$$

hydrocarbons produce fundamentally the same chemicals regardless of whether the oxidizing medium be air or oxygen.

Major chemicals . . . In each case the major chemicals are acetaldehyde, formaldehyde, and methyl alcohol in varying proportions. Methylal, propionaldehyde, acrolein, dimethyl acetal, acetone, ethyl, propyl, and butyl alcohols are usually found in minor amounts depending for the most part on the raw material charged. For example, if commercial-grade isobutane is employed acetone then becomes a major chemical. If n-butane is used, the butyl alcohols are produced in greater amounts. Other factors that change the quantities of chemicals produced to a lesser degree are temperature, pressure, and ratio of raw materials.

While it is not my intention to project a mechanism for the oxidation reaction in this paper the equations in Table 1 illustrate some of the reactions that take place.

2. USES OF CHEMICALS

As stated above, the three major chemicals produced by oxidation processes are acetaldehyde, formaldehyde, and methyl alcohol. Since these materials are the basic ingredients from which a large volume of the consumer chemicals are made, they are placed in a class called chemical intermediates.

Three basic chemicals . . . The fact that hydrocarbon oxidation processes produce not one but three basic chemicals is of great importance to any company which wishes to enter the chemical business. While the ever-changing chemical industry is continually outmoding end-product chemicals, new uses are always being developed for these high-volume, low-cost chemical intermediates. Conditions can also be varied to produce substantial quantities of acetone, a similar type chemical. The other chemicals made in lesser amounts are presently enjoying a vast new market created by the addition of mixtures of them to gasoline for use as an anti-stalling agent.

TABLE 2—CHEMICALS FROM THREE BASIC OXIDATION INTERMEDIATES

Acetaldehyde:	Formaldehyde:
Pentaerythritol	Pentaerythritol
Acetic acid	Plastics
Acetic anhydride	Resins
n-Butyl alcohol	Adhesives
Aldol	Ethyl glycol
Butyraldehyde	Hexamine
2-Ethylhexanol	Vicara fiber
Butadiene	Paraformaldehyde
DDT	Trioxane
1,3-Butylene glycol	**Methanol:**
2-Methyl-5-ethyl pyridine	Formaldehyde
Vinyl acetate	Methylacrylate plastics
	Methyl chloride

TABLE 3—OTHER POSSIBLE DERIVATIVES OF OXIDATION CHEMICALS

Acrylonitrile	Methylal
Acetaldehyde esters-ethyl acetate	
Ethyl alcohol	Maleic anhydride

Many more chemicals . . . Table 2 lists chemicals now being produced in large quantities from the three basic products of hydrocarbon oxidation.

Chemicals not now being produced from oxidation intermediates but which have excellent possibilities for being so produced are listed in Table 3.

Acetaldehyde . . . This is one of the most versatile organic chemicals. It is the most valuable product of an oxidation process. It is produced in the United States at a rate in excess of 600,000,000 lb. per year. Approximately 70 per cent of this production is converted to acetic acid and acetic anhydride which, in turn, are consumed chiefly in the textile industry to make acetate rayon, one of our important fibers.

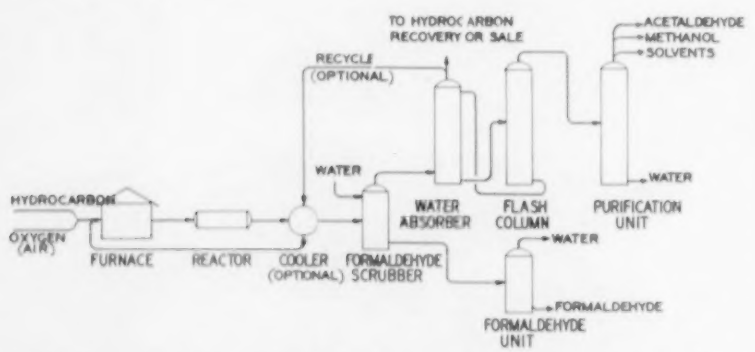
Acetic acid also finds a large market in the plastic industry, whose products are molded into such items as toys, telephone bases, automobile parts, and brush handles. The paint industry uses large amounts of acetic acid in the form of acetate solvents. Many additional applications for acetaldehyde in the paint and plastic trade are created by its conversion to butyl alcohol and 2-ethyl hexyl alcohol.

By combining acetaldehyde with formaldehyde a compound called pentaerythritol can be made. This product has been very rapidly displacing glycerin in many paint formulations. Its growth in the past few years has been almost phenomenal jumping from 14,000,000 lb. in 1946 to 60,000,000 lb. in 1954. Additional uses for acetaldehyde are in the manufacture of explosives, medicinals, insecticides (DDT in particular), the vinyl pyridines, and in vinyl acetate.

Formaldehyde . . . Since its commercial introduction to the United States in 1901, this chemical has risen to the point where its output now ranks high among the tonnage organic chemicals marketed. Well over 1 billion pounds of formalin (37 per cent aqueous solution of formaldehyde) was produced in 1954.

The principal use for formaldehyde is in the plastic industry where it is a necessary ingredient for the phenolic, urea, and melamine resins. The phenolic (bakelite) resin is molded into radio and television cabinets, electrical appliances, electronic tubes, and telephone equipment. The urea and melamine resins are employed for plastic tableware, to make textiles waterproof and crease resistant, and to make wet-strength paper.

These resins are also extensively utilized in the adhesive and coating fields. Plywood is almost exclusively glued with these resins; wood chips and saw-



Generalized flow sheet of an oxidation process—major products of hydrocarbon oxidation are formaldehyde, acetaldehyde, and methane.

THE AUTHOR

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dust are converted to wallboard and counter tops. Recently, a modified phenol - formaldehyde resin has been making great strides in the railroad equipment field in the manufacture of all-wood laminated box cars.

Other derivatives to which formaldehyde is readily converted are: (1) ethylene glycol, the important antifreeze and plastic raw material; (2) pentaerythritol, noted above, and (3) hexamine, the raw material for the explosive RDX and a growing intermediate for plastics.

Formaldehyde also finds minor applications in such items as embalming fluid, preservatives, medicinals, germicides, boiler treating compounds, oil-well drilling muds and the newly publicized Salk vaccine for polio. Here it is used to kill the live polio virus. Many new and potentially large uses are now in the development stage—such as a substitute for sulfuric acid in the treating of gasoline in order to stabilize it against gum formation.

Methanol . . . The consumption of methyl alcohol has grown until it enjoys the largest market of all the oxygenated chemicals. Approximately 1 billion pounds of it was produced last year. Thirty-five per cent of this was consumed as automobile antifreeze. In this field it is superior to all other antifreezes both from the standpoint of cost and quality, except possibly with regard to volatility, in which case ethylene glycol has advantages in some climates.

Another 35 per cent of methyl alcohol production is converted to formaldehyde (90 per cent of which is made in this manner) with its many uses as described above. Methyl alcohol also finds applications as a powerful solvent, in paint removers, in plastics (Lucite, Plexiglass), in dyes, in leather treating, in pharmaceuticals, and in rubber chemicals. As mentioned, a new and very important use for methyl alcohol as an additive to gasoline to prevent cold-weather stalling is now meeting with acceptance among all of the major oil companies.

3. OXIDATION PROCESSES

Walker process . . . This process, as operated at Tallant, Okla., was discovered indirectly. It grew out of the search for a means of reducing pipeline corrosion. Such corrosion was attributed to the natural oxidation of the entrained hydrocarbons to oxygenated chemicals.

The Walker process originally involved oxidation of partially stripped natural gas with injected compressed air at a pressure of about 300 psig. and 800° F. over an aluminum phosphate catalyst. After installation of the Tallant plant, other small oxidation units were constructed by Cities Service near Oklahoma City and Seminole, Okla. The Seminole plant was shut down recently. The products from the Oklahoma City plant are shipped to Tallant for separation and purification of the chemicals. The combined stream going to the separation section consists of 15 per cent methyl alcohol, 22 per cent formalin, 3 per cent acetaldehyde, and 60 per cent mixed miscellaneous solvents and water. Total production is relatively small, as indicated in Table 4.

TABLE 4—WALKER PROCESS PRODUCTION

Chemical—	Approx., lb. chemicals per lb. butane	Prod. (lb./year)
Methyl alcohol	0.95	5,000,000
Formaldehyde (100 per cent)	0.85	4,300,000
Acetaldehyde	0.39	2,000,000
Other solvents	1.30	6,500,000

McCarthy process . . . This process as developed by Fomac Engineers was designed to take maximum advantage of the natural-gas conditions of the McCarthy plant located at Winnie, Tex., and was operated only during 1949.

The novel portion of the process was based on this premise: (1) introduce relatively pure oxygen into an available 800-psig. natural-gas stream containing about 5 mole per cent of ethane, propane, and butane; (2) the oxygen would preferentially oxidize the ethane and heavier hydrocarbons to valuable chemicals and still leave a substantially nitrogen-free and salable natural gas at 700 psig. without need for further booster compression for this residue gas.

Partially stripped residue gas at approximately 800 psig. from a nearby natural-gasoline plant was mixed with 95 per cent pure oxygen and preheated to the reaction temperature of about 700° F. The oxygenated chemicals contained in the natural gas leaving the reactors are removed by water extraction and delivered to the separation and purification systems for further processing. The stripped gas is then dried and delivered to a pipeline at 700 psig. for sale as fuel. Like the Walker process, and in contrast to the processes developed by Bludworth and Meyer, it is a once-through operation.

After attempting for over a year to line out the process without success, the plant was finally shut down and the process abandoned early in 1950. It is not the purpose of this paper to recount all of the reasons for this failure, but, in our opinion, the most important cause was the high conversion of oxygen to the cheaper chemicals (methyl alcohol to the extent of 70 per cent and formaldehyde) and the oxides of carbon (CO and CO_2). This made the process fundamentally uneconomical. Although the heavier hydrocarbons were preferentially oxidized to some extent, much more methane was converted than originally predicted, a fact that changed the design yields considerably.

Based on the best data obtained from operation of the plant, the consumption of the natural-gas hydrocarbons and yields of the various chemicals produced are given in Tables 5 and 6.

TABLE 5—McCARTHY PROCESS—CONSUMPTION OF HYDROCARBONS

(Basis: 95,000,000 cu. ft. per day raw material throughput)

	Cu. ft./day (actually oxidized)	Gal./day
Methane	1,439,000	24,400
Ethane	514,000	13,100
Propane	396,000	11,100
Isobutane	26,000	900
n-Butane	16,000	500
Total	2,391,000	50,000

TABLE 6—McCARTHY PROCESS—YIELDS OF CHEMICALS

	Lb./day	Lb./gal. hydrocarbon
Acetaldehyde	4,700	0.09
Methyl alcohol	113,200	2.26
Formaldehyde	18,400	0.37
Others	21,700	0.43
Total	158,000	3.15

Bludworth process . . . This process was placed in operation by Celanese Corp. at Bishop, Tex., in 1945. It is a recycle process involving oxidation of propane and butane with compressed air. It consists of passing a commingled gaseous vehicle stream, made up of approximately seven volumes of recycle gases, one volume of hydrocarbon feed, and two volumes of air at 100 psig. into a furnace. Here the stream is heated to about 700° F.

The gases are then fed to an empty steel tube where the reaction takes place, accompanied by a sharp temperature rise to about 850° F. due to the exothermic nature of the reaction.

The hot gaseous reaction product is fed to the bottom of a quench absorber in which the gases are quickly cooled to about 200° F. by contacting them with a countercurrent flow of cold dilute aqueous formaldehyde solution. Most of the formaldehyde produced by the oxidation is removed in this step also. The formaldehyde solution is recirculated in the tower at a concentration of about 12-14 per cent formaldehyde, and is continuously drawn off to the formaldehyde purification unit while fresh water is added for makeup.

The mixture still containing such products as acetaldehyde, propionaldehyde, acetone, methyl and higher alcohols, unconverted hydrocarbons, oxides of carbon and nitrogen, is con-

ducted to a water absorber where the oxygenated compounds, being water soluble, are separated while the unconverted hydrocarbons and oxides of carbon and nitrogen are vented out the top of the absorber. The dilute aqueous chemical solution is fed to a flash tower in which the chemicals are distilled overhead and the water bottoms are cooled, neutralized with caustic, and returned to the water absorber to absorb more chemicals.

Approximately 75 per cent of the gases vented from the absorber are recycled back through the furnace along with fresh hydrocarbon feed and air, while the remainder is taken to a conventional hydrocarbon recovery unit to be stripped of its higher hydrocarbons (propane and heavier) which are then added to the recycle gas stream. Since the exit gases from the recovery unit will not support combustion, they are passed again through the preheat furnace and then utilized as a source of power to drive the fans on several of induced-draft cooling towers in plant.

With a few exceptions all of the finished chemicals are a result of the original oxidation of the hydrocarbons. In the purification units all chemicals are purified for sale with the exception of acetaldehyde which, upon separation, is converted to acetic acid by oxidation with air in another unit.

The purification step consists of highly specialized distillation operations. Acetaldehyde is removed from the crude chemical mixture by fractionation. The remaining mixture is then hydrogenated to convert all of the olefinic compounds and aldehydes into saturated compounds and alcohols respectively.

The acetone and methanol present are separated and purified by a combination of extractive distillation and azeotropic distillation processes, while the higher alcohols, for the most part, are dried and marketed as mixed solvents. The crude formaldehyde stream is neutralized with lime, pressure and vacuum distilled to increase its concentration, extracted to remove impurities, and ion exchanged to meet commercial grade specifications.

Special features . . . Some of the unique features of this process are:

1. The pH of the crude formaldehyde stream is closely controlled by the addition of dilute caustic. This is done to minimize formation of undesirable side products such as formals, acetals, etc. Formation of these byproducts would result in smaller yield of the desirable major chemicals.

2. Peroxide decomposers are installed on the outlet side of the reactors. These consist of an expanded section of the reactor that is packed with a ceramic material.

"One way to eliminate surplus propane and butane supplies is to find new uses for them. The direct oxidation of these hydrocarbons into oxygenated chemicals appears to be very favorable at this time."

3. Waste-heat recovery is employed. A portion of the exothermic heat of reaction is employed to furnish heat to the recycle gases. Over-all effect of this waste-heat utilization is to increase yields of major reaction products.

The recovered yields of chemical are approximately as given in Table 7, expressed in pounds per gallon of fresh hydrocarbon feed:

TABLE 7—APPROXIMATE YIELDS, BLUDWORTH PROCESS

	Yield, lb./gal. of fresh feed		
Chemical—	Propane	n-Butane	i-Butane
Acetaldehyde	1.38	1.5	0.76
Formaldehyde	1.5	1.6	1.0
Methanol	1.2	0.98	0.62
Mixed solvents	0.36	0.60	0.61
Acetone	0.10	0.20	1.20
Total	4.54	4.88	4.19

Pampa plant . . . A recent installation of Celanese Corp. is the Pampa plant in the Texas Panhandle. This plant employs a liquid-phase, high-pressure oxidation of butane. The process is carried out at about 850 psi. using acetic acid as a diluent. The catalyst is a metal acetate (of the cobalt, manganese, or nickel family). One of the unique features of the Pampa process is that it does not make any formaldehyde.

Meyer process . . . The Meyer oxidation process utilizes oxygen, fresh propane or butane feed, and hydrocarbon-rich recycle gas substantially free from oxygenated chemicals in such a manner that the oxygen content of the gas mixture is 3-6 per cent.

This gas mixture is preheated to the reaction temperature of 600°-700° F. and passed into an empty tube or reactor, where the hydrocarbons are partially oxidized by the oxygen present. The gaseous reaction products pass through a heat exchanger, where they are cooled by giving up heat to the unreacted recycled hydrocarbon gases. Upon being cooled to 100°-160° F., the gases are extracted with water at the same temperature. The nonvolatile oxygenated chemicals, such as formaldehyde and acids, are retained in the water and removed from the system for purification.

The volatile oxygenated chemicals, unreacted hydrocarbons, and fixed gases, are then led to a water absorber, where the volatile chemicals remain in the water while the unoxygenated hydrocarbons pass out through the top of the absorber, some to be recycled, and the remainder to be processed to recover unconverted propane and butane from the vented gases.

The absorber water containing the volatile oxygenated chemicals, principally acetaldehyde, methyl alcohol, and higher alcohols, is led to a flash column, where the volatiles are distilled overhead, and the water residue is returned to the absorber to recover more products. The crude chemicals from the flash column are then taken to a series of distillation columns for purification.

The purification of the chemicals is largely accomplished by conventional means, such as distillation, extractive distillation, azeotropic distillation, and absorption.

The Meyer process yields are given in Table 8, expressed in pounds per gallon of fresh hydrocarbon feed:

TABLE 8—YIELD, MEYER PROCESS

	Yield, lb./gal. of fresh feed		
Chemical—	Propane	n-Butane	i-Butane
Acetaldehyde	1.80	1.6	0.75
Formaldehyde	1.6	2.0	1.2
Methyl alcohol	1.4	1.0	0.20
Acetone	0.15	0.2	1.40
Mixed solvents	1.0	1.5	1.6
Total	5.95	6.3	5.15

These yields of acetaldehyde, formaldehyde, and methyl alcohol may be increased an additional 10-15 per cent by making a few minor technical changes.

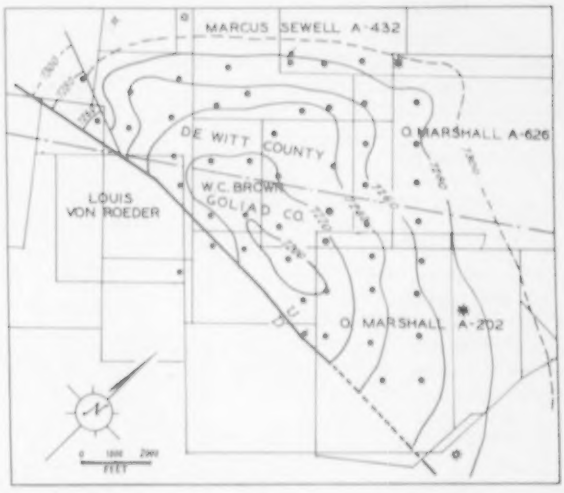
The Meyer process recently reached commercial stature with the completion of a plant at Conroe, Tex. This plant was put on stream on December 1, 1954, and subsequent material-balance runs have indicated that it is already producing chemicals at the estimated yields. Also, it is expected that when the operators are fully trained, and several obvious refinements are installed, the chemical yields will be substantially higher than originally anticipated.

". . . hydrocarbon oxidation processes produce not one but *three* basic chemicals . . . new uses are always being developed for these high-volume, low-cost chemical intermediates."

Good Engineering Pays Off

. . . in Slick-Wilcox field

Corrosion and salt-water-production problems are licked by chemical inhibitors and individual well recompletions.



STRUCTURE MAP of the Wilcox Massive sand reservoir in Slick-Wilcox field. Fig. 1.

by W. H. Rosser

EARLY performance of Slick-Wilcox field indicated a good, effective water drive existed, and efforts were made to take full advantage of this efficient recovery mechanism. Oil recovery to date and present producing rate give evidence of the success of this effort.

The most serious field producing problems were corrosion and salt-water production. The former has been satisfactorily controlled by chemical inhibition, while water production has been curtailed by individual well recompletions.

The field, located in Goliad and DeWitt counties, Texas, was discovered in May 1943. The discovery well was Continental Oil Co. 1 A. S. Wood, which potentialed 230 bbl. of 36° A.P.I.-gravity pipeline oil per day flowing on a 10/64-in. choke with tubing pressure of 1,075 psi., casing pressure of 1,425 psi., and a gas-oil ratio of 439 cu. ft. per barrel.

Production was from the Wilcox Massive sand occurring at a depth of about 7,600 ft. Development of the 1,920-productive-acre reservoir was completed by June 1945, with a total of 48 producing oil wells and 3 dry holes.

Operators in the field consist of Continental Oil Co., Sunray Oil Corp., Forest Oil Corp., Superior Oil Co., and Lyons, McCord, and Logan.

Development . . . Development of the field was on 40-acre spacing as required by Petroleum Administration for Defense during the war period.

Author is with Continental Oil Co., Houston. Paper presented at 1955 T.P.R.C. meeting, College Station, Tex.

General completion practices were to wire-line core through the producing sand section, cement casing on bottom, and selectively perforate the desired interval. Average initial well potential for the field was 220 bbl. of oil daily flowing on a 10/64-in. choke with tubing pressure of 1,000 psi. and a gas-oil ratio of 700 cu. ft. per barrel.

Geology . . . The Wilcox Massive sand reservoir is formed by closure against the north and upthrown side of a major east-west fault, as illustrated by Fig. 1, a structure map of this field. Total thickness of the Massive sand exceeds the productive closure of the reservoir, which results in the entire productive area being underlain by water.

Exact limits of the aquifer is unknown; however, the presence of an active water drive has been established. A number of noncontinuous shale streaks and some large shale lenses occur in the sand section, but there is no segregation of the sand into separate reservoirs.

The gas-oil contact was established at 7,250 ft. subsea with an oil-water contact at 7,300 ft. subsea, giving a 50-ft. oil column. A small free gas cap originally existed which covered approximately one-third of the oil reservoir.

General physical properties of the reservoir are as follows:

Porosity, per cent	21.8
Permeability, md.	555
I. w. s. per cent. (est.)	25.0
Original reservoir pressure, psig.	3,350
Original reservoir temperature, °F.	218

General physical properties of the fluid are as follows:

Gravity of oil, °A.P.I.	35.0
Solution G.O.R., cu. ft. per barrel	732
Formation volume factor	1.49
Bubble-point pressure, psi.	3,243

Reservoir performance . . . As of January 1, 1955, cumulative production from the Slick-Wilcox Massive sand reservoir was:

Oil, barrel	12,295,768
Water, barrel	13,312,399
Gas, M.c.f.	16,622,084

It became evident early in the life of the field that water production would be a prime factor in producing this field. Primary field studies indicated that the reservoir pressure would not be expected to decline below 3,000 psi. due to the anticipated active water drive. Further, with such a slight decline in bottom-hole pressure, the free gas cap would not expand appreciably.

A study of individual well performance reveals that the rise of the water table has been erratic. This is probably the result of two combined factors: perforated interval in individual wells, and presence of shale streaks and lenses throughout the sand body.

The pressure history of the reservoir has performed to date as expected. With a calculated reservoir pressure for January 1, 1955, of 3,075 psi., a decline of 275 psi. from original pressure has been experienced. This represents a production of 44,712 bbl. of oil per pound reservoir pressure drop to date.

Water production which began in appreciable quantities during 1945, has gradually increased to the present 79 per cent for the field. Frequent individual well recompletions account for fluctuating water production.

Operating Problems

With gradually increasing gas production and the need for high-pressure gas to gas lift wells in the field a compressor plant with field-wide gathering system was constructed in 1950 jointly by the operators in the field. The plant consists of four 600-hp. compressors designed for maximum output of 9,600 M.c.f. daily operating at a suction pressure of 5 to 15 psig. and discharge pressure of 1,000 psig.

A field gas-lift system was installed to furnish gas throughout the field for gas-lift purposes. Contract for sale of all excess casing-head gas over gas lift needs was made with United Gas Corp.

Salt-water disposal . . . With the steady increase in water production and anticipated continued increase, it became evident early in the life of the field that disposal of salt water would be a problem. By the middle of 1947 the general use of surface evaporation pits had become unsatisfactory, and a water-disposal system was designed, utilizing a closed gravity system from individual tank batteries to an injection well.

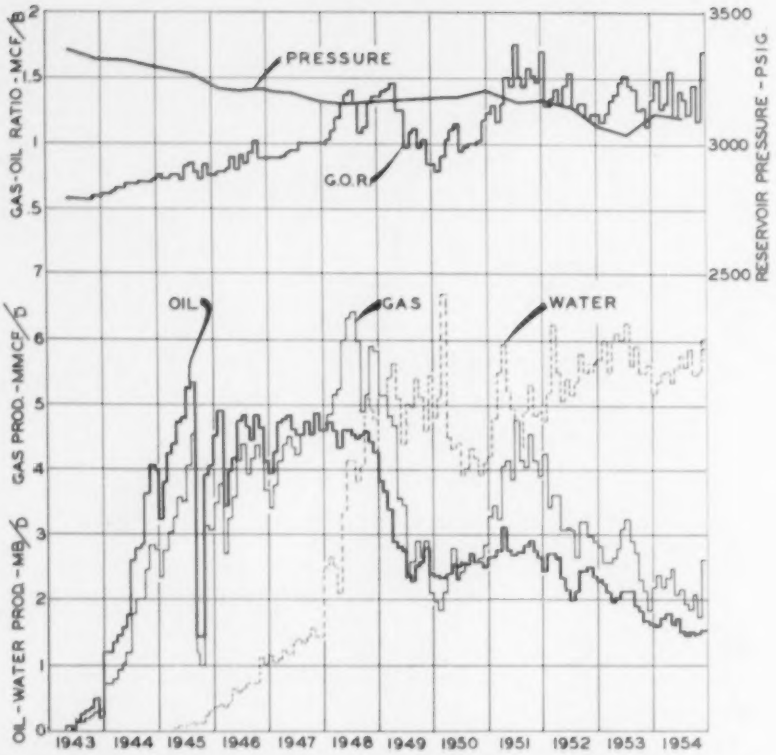
Although injection by gravity was initially possibe, pumping facilities were installed at the well to prevent possible future interruptions in satisfactory injection due to mechanical trouble.

Disposal is into a salt-water sand occurring at a depth of approximately 3,200 ft. Although one well was initially satisfactory, the increased water production has necessitated the addition of another disposal well in the field. Initial injection was at an average rate of 1,500 bbl. per day while present injection rate is approaching 6,000 bbl. daily.

Corrosion . . . To date probably the biggest operating problem in the field has been corrosion. This problem became evident as early as 1947 when replacement of several joints to entire tubing strings were required in wells during workover operations. Corrosion is of the low-pressure sweet-oil-well type and becomes of serious nature when water production reaches 50 per cent or more.

A high percentage of barium in produced waters of this field further complicates the problem. It was found that installation of gas-lift equipment, which was necessary to maintain production from wells making high water percentage, resulted in accelerated corrosion attack.

Generally speaking, the greater portion of corrosion attack in this field is of the pit type, thus indicating the major corrodent to be CO_2. There is also indication that sufficient fatty acids are present to influence the rate as well as type of attack.



RESERVOIR PERFORMANCE CURVE for Slick-Wilcox field, DeWitt and Goliad counties. Fig. 2.

During primary study of the corrosion problem an attempt was made to correlate the rate of corrosion activity by measuring iron concentration in the produced waters. It was soon found, however, that this method was unsatisfactory and unreliable.

The use of steel coupons placed at various depths in the producing string was next instigated with favorable results, and this method of determining the degree of corrosion activity in individual wells is presently still in use.

The general method in use for corrosion protection is an inhibition program utilizing commercial organic inhibitors. This method has been satisfactorily carried out through injection into the casing annulus.

Remedial work . . . Remedial work for the control of gas and water production throughout the field has been very satisfactory in most cases. Early in the life of the field considerable difficulty was experienced in obtaining satisfactory cement squeeze jobs.

Due to the characteristics of the Wilcox formation sufficient cement could not be squeezed into the formation to insure a satisfactory job. General practice since, however, has been to squeeze mud acid ahead of the cement and little trouble has been encountered in obtaining a satisfactory squeeze job.

Since there have been no completions in the gas-cap area and little gas-cap expansion, there has been little cause for trouble in gas control. There have been occasions where primary casing cement jobs have failed, but no trouble was encountered in recementing for a satisfactory shutoff.

Control of water production has been satisfactorily handled through recompletions. In all cases it has not been possible to obtain water-free oil production by recompletion higher in the sand section.

This is due to the presence of an irregular water table resulting probably from two things: noncontinuous shale lenses throughout the sand body and the inconsistent practice of the various operators in selecting the sand section for completion.

Artificial lift . . . Due to the high water percentages and the low-formation gas-oil ratios of the wells, it has been necessary to install artificial-lift equipment in most of the wells in the field. Gas lift is the universal method in use, and constant-flow-type valves with open-type installations have been the general practice due to the large fluid volumes neccessary to lift and the high operating fluid levels. Gas for gas-lift purposes is obtained by compressing casing-head gas produced in the field.

OCTANE NUMBERS IN LESS TIME

C.-R. procedure is fast and accurate with no change in A.S.T.M. equipment

by Hudson W. Kellogg

IT is estimated that more than 3.5 million octane number determinations are made annually by the petroleum industry on motor fuels. By the standard methods, in excess of 1.8 million man-hours are required. Shorter testing methods therefore can achieve a substantial saving to the industry.

The compression-ratio procedure, developed by Ethyl Corp.:

- Saves about 65 per cent of the time required to obtain octane numbers by the standard A.S.T.M. research or motor methods.
- It saves time because the periods of waiting for the engine to reach equilibrium after each switching back and forth between sample and reference fuels, as required by the A.S.T.M. methods, are practically eliminated. Knockmeter interpolation and the time it requires is also eliminated.
- Requires fewer reference blends, and less reference fuel is consumed.

All these factors save money for the refiner.

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Same equipment . . . No changes in apparatus are necessary with this compression-ratio procedure. All of the test conditions to which the sample is subjected such as temperatures, pressures, fuel-air ratio, and knock intensity are the same as in the A.S.T.M. methods. Reference fuels are used to establish standard knock intensity, and the compression ratio at which standard knock intensity occurs on the sample is then used in determining the octane number from the standard A.S.T.M. guide tables.

Every sample tested is either preceded or followed by a check with a reference-fuel blend of not more than two octane numbers from the sample. Thus there is a further similarity to the A.S.T.M. methods in that the sample tested is within two octane numbers of a reference fuel.

To establish the amount of time which this compression-ratio (C.R.) procedure saves, a recent period was studied during which some 56,000 octane numbers were obtained, 20,000 by the C.R. procedure, and the remainder by the standard A.S.T.M. research and motor methods. The time consumed per octane number determination by the C.R. procedure was 65.2 per cent less than the time used per octane number determination by the A.S.T.M. methods.

TABLE I—ANALYSIS OF TEST RESULTS—A.S.T.M. RESEARCH METHOD VS. COMPRESSION RATIO PROCEDURE

Sample numbers—	Average Oct. No. A.S.T.M. method	Average Oct. No. C.R. procedure	Difference, C.R. minus A.S.T.M.	Standard deviation A.S.T.M.	Standard deviation C.R.
26 and 36	97.66	97.76	0.10	0.339	0.274
11 and 8	95.06	94.98	—0.08	0.173	0.218
14 and 38	94.40	94.38	—0.02	0.224	0.269
29 and 30	93.36	93.06	—0.30	0.346	0.430
25 and 7	91.96	91.94	—0.02	0.316	0.274
2 and 4	91.74	91.78	0.04	0.173	0.112
15 and 6	91.70	91.96	0.26	0.552	0.400
16 and 20	92.84	92.86	0.02	0.328	0.442
3 and 13	89.44	89.30	—0.14	0.387	0.274
12 and 35	90.84	90.72	—0.12	0.274	0.260
24 and 32	89.88	89.96	0.08	0.371	0.339
10 and 40	87.36	87.42	0.06	0.224	0.409
27 and 21	88.36	88.28	—0.08	0.339	0.421
31 and 17	88.26	88.20	—0.06	0.212	0.436
39 and 18	88.06	88.14	0.08	0.255	0.442
1 and 9	87.28	87.32	0.04	0.240	0.269
5 and 19	87.72	87.64	—0.08	0.218	0.274
28 and 33	84.22	84.36	0.14	0.250	0.430
37 and 22	87.40	87.38	—0.02	0.332	0.296
23 and 34	92.94	92.98	0.04	0.141	0.357
Average	90.52	90.52	†—0.003	0.285	0.331

*These values are averages of five ratings made in five different laboratories. Ten different operators and engines were involved. †Algebraic average.

Good accuracy . . . The accuracy of this compression-ratio procedure is equivalent to that obtained with the A.S.T.M. methods. This was determined by having each of five laboratories test 20 unknown samples of diverse composition by both the A.S.T.M. research method and the compression-ratio (C.R.) procedure. The samples consisted of seven commercial premium fuels, nine commercial regular-grade fuels, two National Exchange Group samples, and two standardization fuels.

To insure blind testing, the samples were prepared in duplicate and coded—a different coding being used for each of the duplicates also. The program called for testing one of each pair of coded duplicates by only one of the test methods. Sample averages, standard deviations and other data were computed and are shown in Table 1.

Careful analyses of the data were made in accordance with methods described by Youden.[1] No. "statistically significant" differences in precision (measuring error) were found between the two methods when the "F" test was applied to the data. The standard "t" test was applied to the averages on each sample and no "statistically significant" differences occurred on 19 out of the 20 samples.

The averages for Sample 29-30 showed a "significant" difference but, for 95 per cent probability, one such difference could be expected in 20 tests, and therefore it can be concluded that there are no "statistically significant" differences in these data.

Results compared . . . As a further test, the laboratory technicians were asked to get the octane number using this compression-ratio procedure after obtaining the A.S.T.M. research method octane number on 440 samples divided among five laboratories. A similar program was run using the motor-method test conditions on 220 fuels. The differences between the individual

A.S.T.M. and C.R. ratings on each sample were computed and from them a root-mean-square deviation calculated.

For the research method a value of 0.279 resulted and for the motor method 0.272 was obtained. These root-mean-square values compare quite favorably with those achieved by National Exchange Group laboratories.

Several small-sample or micro methods[2,3,4] have become available in recent years. They have proved valuable in experimental work where the volume of sample available is small. Satisfactory accuracy can be obtained by engine operators skilled in these methods. Some of these micro methods are also being used to a limited extent in refinery control work because they are faster but sometimes the more important samples are retested later by the appropriate A.S.T.M. method as a check.

All of the micro methods require carburetor modifications. The compression-ratio procedure, while not a small sample method, requires no change from standard A.S.T.M. equipment and therefore may be used readily by any refinery in control work.

Thus, this compression-ratio procedure of obtaining octane numbers saves nearly two-thirds of the time required by the standard A.S.T.M. research or motor methods, is easy to use, and gives accuracy comparable to the standard methods. It is applicable to refinery and research laboratories except where small sample size necessitates the use of micro methods or where contractual agreements specify the use of A.S.T.M. methods.

Procedure

In determining octane numbers with this compression-ratio procedure, the A.S.T.M. engine is first adjusted to standard knock intensity, in accordance with the A.S.T.M. methods, on reference fuel of the approximate octane number of the sample. The engine is then operated on the sample, with the fuel-air ratio adjusted to give maximum knock.

The engine compression ratio is then adjusted to give a 55 reading on the knockmeter. The compression-ratio micrometer reading is obtained and from it the octane number of the sample is found using the table of micrometer settings for standard knock intensity in the appropriate A.S.T.M. method.

Details . . . Warm up the engine and, after it has reached equilibrium, check it for rating accuracy with A.S.T.M. standardization fuels in the octane number range of the samples to be tested using either the A.S.T.M. method or in accordance with the following compression-ratio procedure:

1. Obtain standard knock intensity in the usual way by adjusting the compression ratio to the micrometer setting specified in the A.S.T.M. table (for the method being used) on a reference-fuel blend whose octane number is close to the expected octane number of the sample to be tested. Be certain that the carburetor is at the maximum knock fuel level.

For engines not equipped with barometric compensators, apply the A.S.T.M. correction for prevailing barometric pressure and adjust the engine to the corrected micrometer setting for the reference fuel selected. It is recommended that engines be equipped with barometric compensators* when using this compression-ratio procedure. They also save time with A.S.T.M. and other knock-testing methods.

2. Adjust the detonation meter controls to give maximum sensitivity with prompt knockmeter response and good stability. Not less than 10 knockmeter divisions per octane number are recommended. (When changing to a different octane range, again check the sensitivity and readjust the detonation meter if necessary.)

3. Adjust the detonation "meter reading" control to give exactly 55 on the knockmeter with the engine running on the reference-fuel blend.

4. Turn the detonation meter operational switch off and, after a wait of 5 seconds, turn it on. If the knockmeter needle returns to 55 ±1, proceed with Step 5. If it does not, repeat Step 4 until two successive readings of 55 ±1 are obtained, readjusting the meter reading control if necessary to maintain this knockmeter reading.

5. Turn the carburetor selector valve so the engine runs on the test sample. Obtain maximum knock in the usual way and adjust the compression ratio to give a knockmeter reading of 55 at the maximum knock-fuel level.

6. Turn the detonation meter operational switch off and, after a wait of 5 seconds, turn it on. If the knockmeter needle returns to 55 ±1, proceed with Step 7.

If it does not, readjust the compression ratio to obtain a knockmeter reading of 55 with the carburetor fuel level at maximum knock. Repeat Step 6 until two successive readings of 55 ±1 are obtained. (The purpose here is to insure that the engine has reached equilibrium and is not drifting.)

*Barometric compensators are available at nominal cost from Pierre J. Malraison, 282 East Third Street, Mount Vernon, N. Y.

7. Obtain the compression-ratio micrometer reading and from it find the octane number of the sample from the appropriate A.S.T.M. table of micrometer settings for standard knock intensity. For engines not equipped with barometric compensators, correct the observed micrometer reading for the prevailing barometric pressure using the A.S.T.M. correction table before obtaining the octane number of the sample from the A.S.T.M. table of micrometer settings for standard knock intensity.

8. When the rating on the sample is more than two octane numbers from the last reference-fuel blend used, reestablish standard knock intensity as in Item 1 using a reference fuel blend within two octane numbers of the sample. If the engine "tracks" the guide curve well, the knockmeter reading on the reference fuel will be 55 and the rating on the sample may be accepted. If not, repeat Steps 3 and 4 on the reference fuel and if necessary also Step 2 and then retest the sample using Steps 5 through 7.

9. Proceed with testing samples using Steps 5 through 8 and recheck standard knock intensity with Steps 1 through 4 after every second sample.

When there are a number of samples to be tested, additional time can be saved by arranging them in either ascending or descending order of expected octane numbers. For example, the operator could start with a reference fuel of 84 octane number, test two samples, then use an 84 or 86-octane reference fuel, then two more samples, etc.

Conclusion

Wherever it is applicable, the use of this compression-ratio procedure permits present equipment to be used more productively. This saves time and money in the determination of octane numbers, both in the research laboratory and the refinery laboratory.

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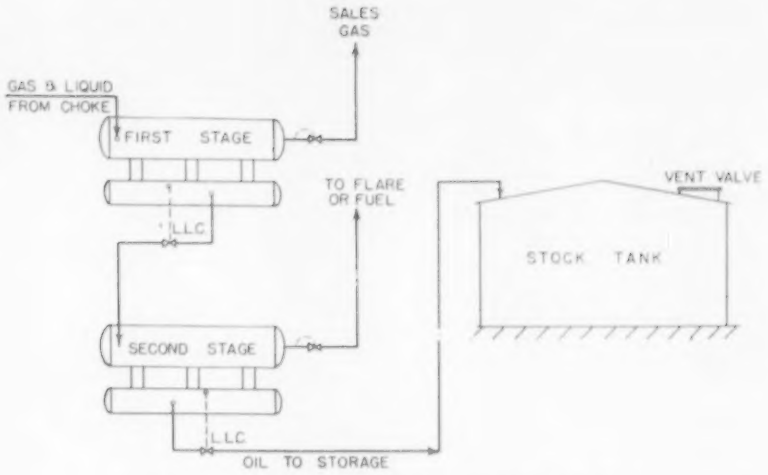
"This procedure of obtaining octane numbers saves nearly two-thirds of the time required by the standard A.S.T.M. research or motor methods, is easy to use, and gives accuracy comparable to the standard methods."



STAGE SEPARATION of oil and gas from the well. Fig. 1.

ELEMENTS OF FIELD PROCESSING

Handling of Separator Liquid—Stage Separation

Part 5 of a Series

by John M. Campbell

THE previous discussions have considered those factors affecting the quantity of separator liquid. It is well then to consider the methods of placing this liquid in the stock tank.

Regardless of the method used, not all of the potential stock-tank fluid in the first-stage separator will be retained in the stock tank. The most efficient method, stabilization, will be discussed in Part 6.

Stage separation . . . This is the name given to the alternative system shown in Fig. 1. The liquid from the first stage is expanded into a separator at lower pressure, in one or more steps, until reaching the stock tank. Each separator is considered one stage, as is the stock tank. The flow sheet in Fig. 1, therefore, represents three-stage separation.

Stage separation is used for two basic purposes:

1. To increase stock-tank recovery by minimizing vaporization.

2. To remove the bulk of the vapors formed when the pressure is lowered so that they will not enter the stock tank.

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The latter is often quite critical for the evolution of large quantities of vapors in the stock tank causes the liquid to "roll," thus increasing "weathering" losses. Many tests have shown that such turbulence is one of several factors that increase tankage losses.

It is obvious that the chief problem with stage separation is the determination of the number of stages and the pressure at which to operate each. The number of stages needed depends on the first-stage pressure and liquid composition as primary variables. Under normal conditions, though, it is usually difficult to justify over four stages because of the economics involved. As more stages are added the amount of stock-tank liquid increases, but usually not enough to pay out the cost of the additional separator(s) in a reasonable period of time.

How many stages? . . . The question still exists as to whether to use two, three, or four-stage separation. In the absence of actual tests this may only be accurately determined by a set of tedious calculations. In the absence of either, the rule of thumb stating that the pressure ratio per stage should not exceed:

5—for gas-condensate production
7—for crude-oil separation where the stock-tank oil gravity is greater than 50° A.P.I.
9—for crude-oil separation where the stock-tank oil gravity is less than 40° A.P.I.

is often useful. Like all rules of thumb, exceptions will be found.

After selection of the number of stages, it is necessary to determine at what pressures the intermediate stages should be operated. Based largely on crude-oil data, the following formula has been proposed:

$$R = (P_1/P_s)^{1/n} \qquad (1)$$

$$\text{or } P_2 = P_1/R = P_s R^{n-1}$$

$$\text{and } P_m = P_s R^{n-(m-1)} \qquad (2)$$

where:

n = number of interstages
R = pressure ratio
P_1 = first-stage pressure, psia.
P_2 = second-stage pressure, psia.
P_m = pressure, psia., for the last intermediate stage used
M = number of the stage
P_s = stock-tank pressure, psia.

Application of Equations 1 and 2 to a three-stage separation problem were $P_1 = 400$ psia. and $P_s = 14.2$ psia. would give

$$R = (400/14.2)^{1/2} = 5.30$$

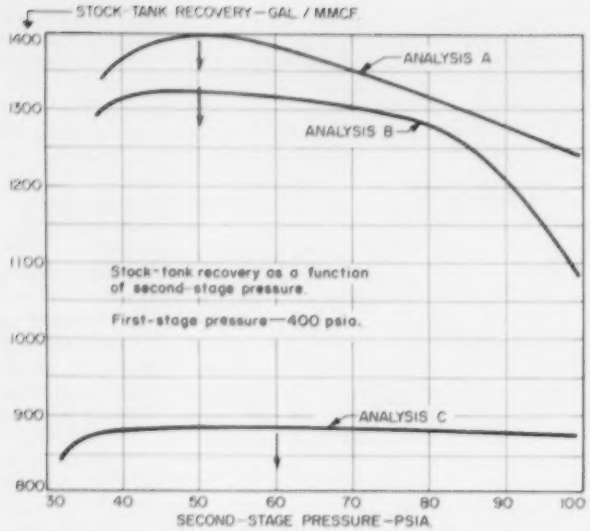
$$P_2 = (14.2)(5.30)^{2-1}$$

$$= 75.3 \text{ psia.} = 61.1 \text{ psig.}$$

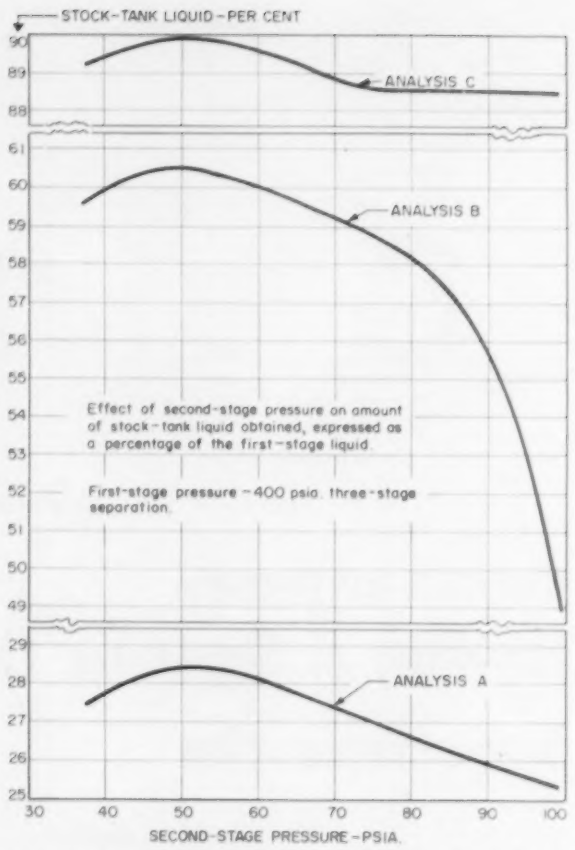
Equation accuracy . . . As might be expected there are many instances where the use of rigorous calculation methods will not check the results given by Equations 1 and 2. These equations, of course, assume that the ratio per stage should be constant. Examination of vapor-liquid equilibrium constants, though, does nothing to support this assumption. In fact, complete analysis of a separation problem often shows that the ratio between the last stage and the stock tank is considerably smaller than that between the other stages.

There is also no provision in this formula for differences in first-stage liquid analyses, which obviously affect the method of handling. In the absence of a complete analysis, however, Equations 1 and 2 provide a quick and easy means of estimating interstage pressures. From a practical standpoint it is often relatively easy then to determine optimum pressures by field experimentation.

Effect of increasing number of stages.



STOCK-TANK RECOVERIES from stage separation of three liquids from Table 2. Fig. 2.



FRACTION OF FIRST-STAGE liquid recovered in the stock tank. Fig. 3.

Table 1 shows some of the data obtained by Whitely[1] illustrating the effect of increasing the number of stages on 13 different well streams. In going from two to four-stage separation recoveries were increased from about 3 to 22 per cent, depending on well-stream composition, with an average increase of 8 per cent. This wide variation illustrates the futility of relying on rules of thumb alone in determining the optimum number of stages.

Examples

The factors that effect stage separation may best be illustrated with a concrete example. Consequently the analyses shown in Table 2 were chosen for study. These represent the analysis of a liquid present in the first stage of separation. Analyses A and B represent liquid separated from the same well stream at 385 psig., the only difference being in the temperature of separation. This has been done to illustrate the effect of the original temperature of separation upon the efficiency of subsequent stage separation.

Analysis C differs from the other two in that it contains relatively little of the components ethane through pentane, by comparison with the other two analyses.

TABLE 1—INCREASE IN STOCK-TANK LIQUID RECOVERY BY INCREASING NUMBER OF SEPARATION STAGES
(Separator temperature, 80° F.)

Test No.	Stock-tank liquid rec. 2-stage separation bbl./ M.M.c.f.	Stock-tank liquid rec. 4-stage separation bbl./ M.M.c.f.	Per cent increase in stock-tank liquid rec. (4-stage over 2-stage)
12	66.0	78.0	18.20
15	11.5	12.2	6.09
16	9.5	9.8	3.16
19	14.7	15.4	4.75
21	35.9	37.1	3.34
28	57.5	62.5	8.70
29	26.2	28.5	8.78
30	26.3	32.1	22.00
31	26.7	30.2	13.10
33	15.3	16.2	5.89
35	15.0	15.5	3.43
38	23.3	24.1	3.59
39	17.0	17.8	4.71

Average per cent increase in stock-tank liquid recovery by adding two intermediate stage separators = 8.14 per cent.

TABLE 2—SUMMARY OF SEPARATOR LIQUID ANALYSES

Component—	Mole per cent Analysis A	Analysis B	Analysis C
Methane	11.91	8.26	10.18
Ethane	21.29	10.60	2.72
Propane	16.86	9.86	3.48
Isobutane	4.98	4.03	2.16
n-Butane	17.79	16.34	2.76
Isopentane	5.44	7.13	1.77
n-Pentane	6.61	9.24	2.20
Hexane	5.64	11.30	*74.73
Heptanes plus	9.48	23.24	
Total	100.00	100.00	100.00
Separation pressure, psig.	385	385	385
Separation temp., °F.	0	80	80
Total first stage separator liquid, gal./M.M.c.f.	4,923	2,193	984

*Hexane plus.

Effect of intermediate stage pressure on recovery . . . Fig. 2 summarizes the stock-tank recoveries to be expected when subjecting the three liquid analyses in Table 2 to two additional stages of separation.

As might be expected, Analysis A gives the highest total recovery because more liquid was present in the first stage separator, per million cubic feet of well stream processed. Although the shape of the curves is different they all pass through a maximum, i.e., the intermediate pressure at which maximum liquid recovery is obtained.

It is obvious though that the intermediate pressure is not critical in the case of Analysis C, a pressure anywhere between 40 and 100 psia. offering a practical solution.

The more pronounced variations shown by Analyses A and B are typical of analyses exhibiting relatively large quantities of pentanes. Pentane is normally a stock-tank component, yet is relatively easy to vaporize. The reduction in recovery at lower pres-

sures is largely due to the loss of this pentane. This phenomenon is particularly pronounced when large quantities of methane and ethane are present.

Below 30 psia. the recovery drops off rapidly. Elimination of the intermediate stage in the case of Analysis B, for example, reduces the recovery to 1,105 gal. per M.M.c.f.

As the curves show, the practical maximum occurs throughout a small range instead of a single pressure.

Effect of composition and pressure on efficiency of recovery . . . Fig. 3 shows the fraction of the first-stage liquid recovered in the stock tank. Here it is readily seen that Analysis A, although showing the highest recovery (Fig. 2), has the greatest loss. On the other hand, stage separation of Analysis C is very efficient.

Several conclusions may be drawn from these results, which have been borne out by field experience. First, stage separation of liquids containing large quantities of methane through pentane usually show large losses when processed by stage separation. Typical of this is the fluid produced when processing gas-condensate wells by means of low-temperature separation.

Second, first-stage liquid in which the potential stock-tank fluid is composed largely of the hexanes plus may usually be efficiently processed by stage separation. Most crude-oil wells producing 45° A.P.I. crude, or less, in the stock tank fall into this category.

The type of plot represented by Fig. 3 is not only valuable in estimating the efficiency of stage separation but is also convenient to use in determining the optimum pressure since fluctuations in recovery are more pronounced.

Inasmuch as there are no correlations at present that accurately give the number of stages needed, as well as the optimum operating pressures, the above results may only be used as a general guide. Practical considerations require that these answers may only be accurately obtained by flash vaporization calculations, verified by field test. The current widespread use of electronic calculators makes this a reasonable and economical approach.

The economics of using various numbers of stages may be determined by employing the cost estimation curves in Part 1 *(The Oil and Gas Journal, March 14, 1955)*. The total cost is obtained by simply adding up the individual separator costs shown. If a prepiped skid-mounted unit is desired, about 10 per cent should be added to the above sum.

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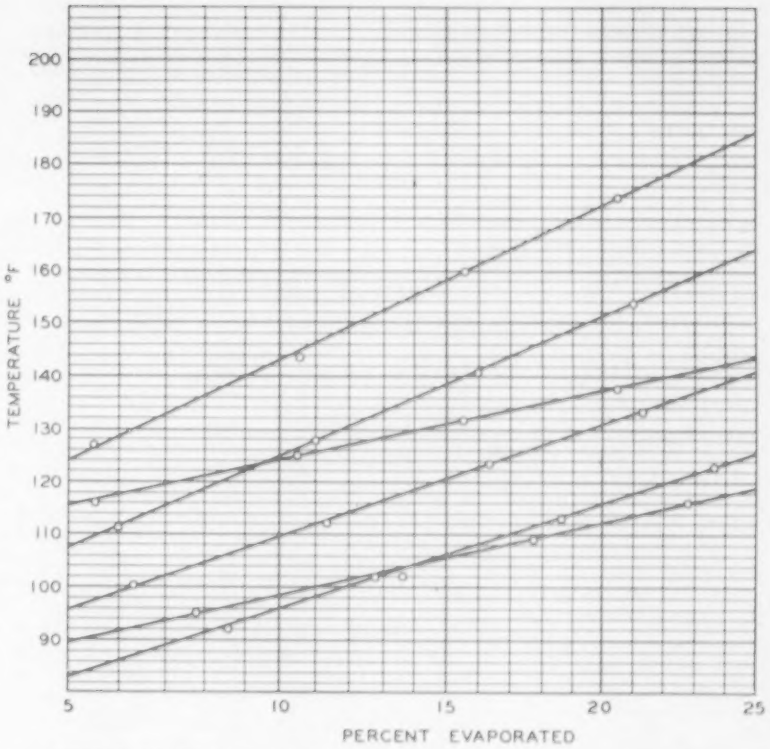

SPECIAL CHART for accurate evaluation of the slope of the 10 per cent point.

The 10 Per Cent Point Slope

. . . and its evaluation as a characterization variable in connection with fuel-vaporization phenomena

by Oscar C. Bridgeman

THE 10 per cent point slope is more and more being used as a characterization variable in connection with fuel-vaporization phenomena. Thus it has found wide application in such problems as (1) the change of vapor pressure with temperature, with vapor-liquid (V/L) ratio, and with evaporation loss; (2) vapor lock in aircraft and in automotive vehicles; (3) fuel-evaporation losses during high-altitude flight; (4) weathering of petroleum products during field storage; (5) vapor losses during fuel handling and transfer; (6) cold-weather starting of gasoline-powered engines; and so on.

In problems of these general types it is customary to use a measured vapor-pressure value (or equivalent) as the major characterizing variable since it effectively integrates the contribution of each component to the vapor composition under the given test conditions. The 10 per cent slope then characterizes the petroleum fraction as regards the lower order effect of the change of vapor composition with temperature, V/L ratio, fuel weathering and so on.

Use of these two characterizing variables thus permits the satisfactory solution of a wide variety of problems without direct knowledge of the vapor or liquid composition.

Significance . . . The significance of the 10 per cent point is intimately linked with the closely specified, although arbitrary, details of the A.S.T.M. distillation tests D 86 and D 216. For a large number of diverse fuels, it has been shown that the temperature at 10 per cent evaporated on the A.S.T.M. distillation curve is essentially equal to the normal bubble point,

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namely the true initial boiling point under conditions of equilibrium vaporization.

Further, the slope of the A.S.T.M. distillation curve at 10 per cent evaporated is related to the slope of the equilibrium vaporization curve in the vicinity of the bubble point. This latter slope is a basic thermodynamic variable in connection with vapor-pressure phenomena, but it is not generally customary to obtain equilibrium vaporization curves on petroleum fuels. Hence it suffices to use the related 10 per cent point slope, since the determination of the A.S.T.M. distillation curve is a customary procedure.

How determined . . . As originally employed, the 10 per cent point slope was the tangent to the A.S.T.M. distillation curve at 10 per cent evaporated. Somewhat later, for convenience in evaluation, the 10 per cent point slope was defined as the slope of the chord between 15 per cent and 5 per cent evaporated, namely, one-tenth of the difference between the temperatures at the 15 per cent and the 5 per cent points. The two values are essentially the same, and in fact it can readily be demonstrated that the slope of the chord and the midpoint tangent are identical, provided the segment of the curve in question can be fitted with a three-constant quadratic equation, which is normally feasible in the region between 5 per cent and 15 per cent evaporated.

Hence, evaluation of 10 per cent point slope has required (1) adding the distillation loss to the per cent distilled (recovered) and plotting against the corresponding temperatures, (2) fitting a smooth curve to the plotted points, (3) reading off the temperatures at 5 per cent and 15 per cent evaporated, and (4) computing 0.1 $[t_{15}—t_5]$. The precision of the 10 per cent point slope, thus evaluated for any given set of distillation data, depended upon the extent to which the observed data were smoothed in drawing the curve, and upon the type of mechanical curve employed.

Since the precision in evaluation of 10 per cent point slope by the above procedure required a large-scale plot of the front end of the distillation curve, the question arose as to the possibility of developing a special coordinate paper for the purpose. Examination of a very large volume of carefully measured distillation data on widely diversified aviation and motor fuels indicated a consistent trend in the curvature of the A.S.T.M. distillation curve over the range from 5 per cent to 25 per cent evaporated, except in those unusual cases where a point of inflection occurred in this region.

The trend in curvature was found to be mildly exponential in form, and of such a nature that the distillation curve between 5 per cent and 25 per cent could be made linear by plotting on a special X scale of per cent evaporated, where X is defined by the equation:

$$X = 2.98 + 0.808\ P - 9.05e^{-0.3P}$$

P is the percentage evaporated. This equation is necessarily empirical because of the arbitrary, though reproducible, conditions of the A.S.T.M. distillation test.

Examples . . . A few typical examples are shown in the accompanying chart, with linear temperature scale and with the special per cent evaporated scale. In customary manner, the distillation loss is added to the per cent distilled and plotted as per cent evaporated against the observed temperature. Aside from the simplicity of being able to employ a straight edge, or a mechanical curve of mild curvature in unusual cases, the special coordinate paper permits valid utilization of the observed temperatures at 5, 10, and 20 per cent distilled in obtaining the best over-all value for 10 per cent point slope.

Thus, direct observation at all four of these percentages distilled enables the smoothing out of random errors in the individual points, an advantage which is lost if only the minimum two points are observed. The chart is applicable to either A.S.T.M. distillation methods D 86 or D 216, which give essentially the same value for 10 per cent point slope for usual types of motor fuels. However, in cases where the distillation loss might be high with Method D 86, it is preferable to employ Method D 216.

While it is always desirable to measure distillation loss with as high a precision as possible, the chart is not very sensitive to errors in distillation loss. Thus an uncertainty of 0.5 unit in distillation loss will normally not introduce an uncertainty of more than 0.1 unit in value of 10 per cent point slope.

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BOOKS

NUCLEAR GEOLOGY, a Symposium on Nuclear Phenomena in the Earth Sciences. Edited by H. Faul. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. $7.00. 1954. 414 pp.

This is the result of an attempt to compile an authoritative text that would cover the rapidly expanding field of knowledge between nuclear physics and geology of the pick-and-handle type. The principal purpose of this book is to introduce the graduate student and the practicing professional geologist to a new approach to some questions about the earth.

The book begins with a simple introduction to nuclear physics, followed by an outline of the more important techniques. The occurrence of radioactive elements in rocks and oceans is discussed, and thermal, physical, and chemical effects of radioactivity are considered.

The study of nuclear phenomena in geologic settings proceeds at an ever-increasing pace, and one man could scarcely hope to be able to summarize the results. Of necessity, therefore, the symposium form has been chosen.

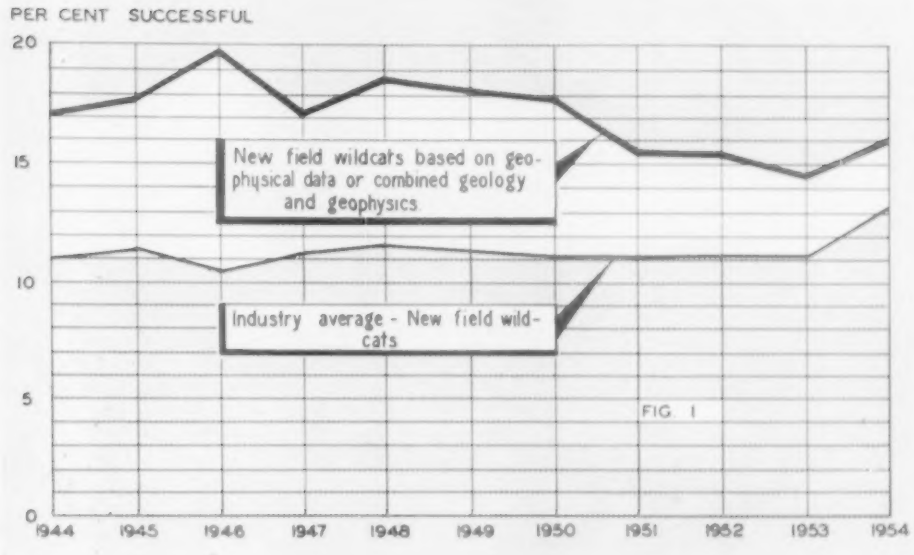
STRATIGRAPHY OF THE UPPER GULF COAST OF TEXAS. By Chas. W. Stuckey, Jr., and Raymond D. Woods. Published by the Houston Geological Society, 1954. Approximately 50 pages including cross-sections, $5.00 plus 0.25 postage. Order from Houston Geological Society, care of Nick Angelos, P.O. Box 2492, Houston 1.

The Houston Geological Society Study Group for 1953-1954 has prepared a series of cross-sections to illustrate the stratigraphy of the Upper Gulf Coast. A brief review of nomenclature and of the general stratigraphy has been compiled to serve as a guide to the literature concerned with this area and as a supplement to accompany the cross section. This summary was not written with the intent of promoting any new usage or of instigating any changes in the nomenclature. It is offered simply as a guide to the stratigraphy as it is presently interpreted by geologists working in the Upper Gulf Coast.

GEOLOGIC MAP OF NEVADA. By E. L. Stephenson. Distributed by Brundiges, 136 North Sierra, Reno, Nev., Box 2455. $25 per copy. On mail orders, shipping charges will be prepaid when payment in full accompanies order.

This is the first published geologic map of Nevada. It includes essentially all geologic information ever published on Nevada, as well as much unpublished information from various sources. While the map was prepared primarily because of the discovery of oil in Nevada, it also is proving useful in uranium exploration in relation to the igneous intrusions and particularly the Tertiary sedimentary rocks which now seem promising as possible sources of uranium. Those who have used the map advise that, in addition to the geology, they consider it an excellent base map of the state.

The map, a single sheet 42½ by 62½ in., is printed in black and white on a scale of 1/500,000, or about 8 miles to the inch. Eight geologic divisions are shown, ranging from pre-Cambrian to Recent. The younger valley fill is shown in a pattern, as are the Tertiary sedimentary rocks that occupy large parts of some of the valley. Therefore, the ranges and valleys are clearly shown in black and white. Other geologic units are shown by letter symbols, so that the map may be colored if desired. The map shows the following features: land net by township and range, ranges and valleys by name, named mountain peaks, lakes and reservoirs, cities and towns, county boundaries, old mining camps, ranches and springs, highways, summits, and passes.



Since 1944, one out of every six new-field wildcats staked on basis of seismic data was successful; industry average for all such tests was only one in nine. This is proof that . . .

GEOPHYSICS Can Find More Oil for You

by Norman S. Morrisey

GEOPHYSICAL data in the hands of a skilled oil finder pay for themselves many times over in terms of new oil found and money saved. Most geologists realize that geophysics can provide an accurate picture of subsurface conditions if properly interpreted.

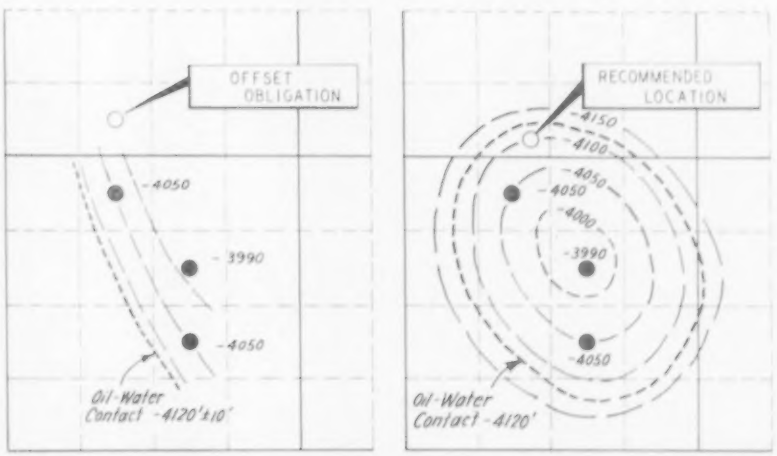
Costs of exploratory drilling can be cut appreciably by using geophysical data effectively. Records show that the success of an exploratory drilling campaign can be improved more than one-third by using geophysics. In 1954 one major company that stresses geophysical exploration had a wildcat success record of 40 per cent in South Louisiana.

During the past 11 years exploration efforts using seismic work have enjoyed a success ratio of 17 per cent. This compares with an over-all industry record of less than 12 per cent for new-field wildcats. (Fig. 1).

Geophysics plays a dominant role in the every-day thinking of the exploration geologists. Here is a partial list showing how the geologist constantly uses seismic data in handling his daily problems:

1. Staking an edge well.
2. Coordinating new well control wild old seismic data.
3. Staking a deep test on a known structure.
4. Confirming a subsurface lead.
5. Processing a submittal.
6. Recommending buying areas.
7. Extending known subsurface trends.
8. Mapping sand pinchouts.

Several hypothetical examples are given below that show how geologists can use seismic data.



Figs. 2A and 2B—Operators were faced with an offset obligation in a newly discovered pool. Seismic work showed that the on-pattern location would be a dry hole; the recommended test was completed for a producer.

Coordination . . . Geophysicists recognize the necessity for close coordination between geology and geophysics. *(See The Oil and Gas Journal, February 14, p. 72.)* Oil companies, however, must go more than half way to provide this information. Many companies in the past have been reluctant to tell

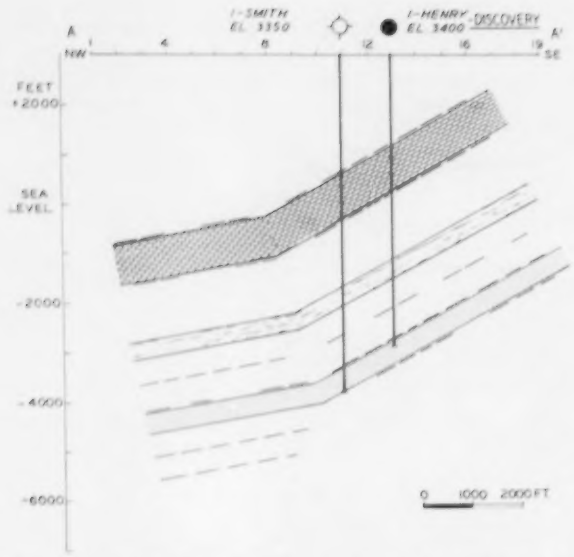


Fig. 3A—The original interpretation condemned the northwest flank of the structure.

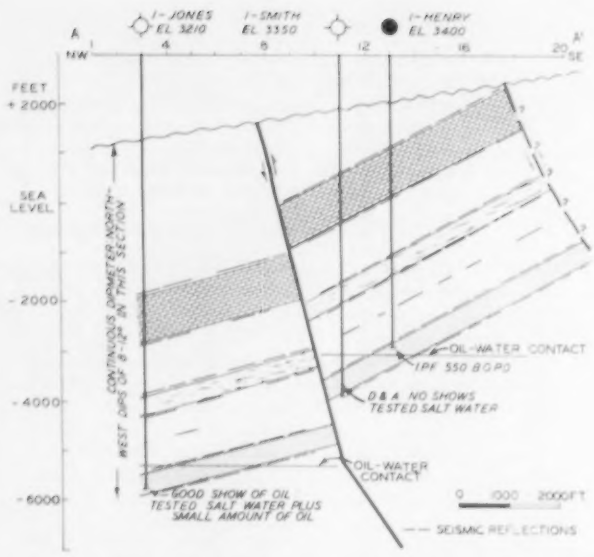


Fig. 3B—Coordination of the seismic with the new well control showed that a possible trap existed updip from the 1 Jones.

contract crews and even their own parties why they are shooting an area. But this attitude is changing as oil companies learn that better seismic work can be done by informed party chiefs.

Briefing seismic crews . . . This can be done in a variety of ways. Some oil companies use "letters of objectives." These letters are essentially a geological report and cover all phases of the seismic program, outlining:

1. The area of interest.
2. Current geological interpretation and inferred structures.
3. Pertinent well data.
4. Brief resume of the local and regional geology, unconformities, reefing, fault patterns, etc.
5. Previous seismic data and experience.
6. Geophysical problems if known.
7. Recommended mapping horizons and reasons.
8. Recommended preliminary seismic program. This may include distance between shot holes, type of shooting (closed loops, dip shooting, etc.), orientation of lines.

Some companies go even further and have a geologist with the crew at all times. Others use coordinators to keep seismic crews posted on geological data and to help with the seismic interpretation. In many instances, the coordinators work up reliable maps based on both the seismic and subsurface data.

Staking Edge Wells

Usually geophysics is considered an exploration method and many companies are reluctant to use seismic work in development drilling. However, this approach can be used, particularly in the early stages of drilling when subsurface control is lacking.

Seismic surveys under favorable conditions can map with an accuracy of ±25 ft. Cost of geophysical work is relatively low, particularly when compared to well costs. A few days' work at the most will ordinarily give the desired information for staking an edge well.

Offset obligation . . . Three wells had been drilled in Eureka pool, a recently discovered structure.* Alpha Oil Co. had an offset obligation. (Fig. 2-A.) Cores and electric logs had established the oil-water contact at minus 4,120 ft. A preliminary geological interpretation indicated that the offset was favorably located.

Alpha had originally bought the 40-acre well site as protection several years earlier. Its geologist recommended that the new structure be shot since experience had shown that these structures were small as a rule.

The producing area covered less than a section, according to the seismic interpretation. (Fig. 2-B.) The offset well was drilled on an off-pattern location, since the original site would have been dry.

Less than $10,000 worth of seismic work resulted in a producer and eliminated a $60,000 dry hole.

*These examples, although hypothetical, are based upon actual cases.

Reviewing Old Seismic Data

Geophysical maps are like the weather and are subject to change. New well control may show that the original map is in error. Some companies make no effort to coordinate

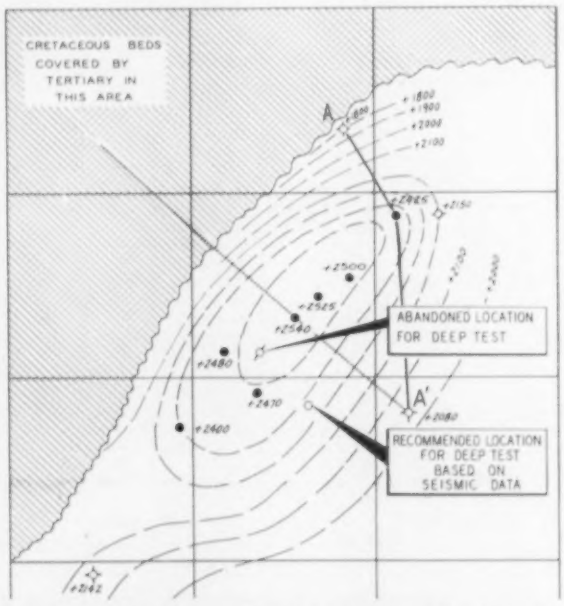


Fig. 4A—Shallow drilling confirmed the surface anticline, but geologists suspected that the crest of the structure would shift with depth.

Fig. 3C—The final seismic map showed nearly 600 ft. of closure against a reverse or thrust fault. Later drilling outlined a sizable producing area.

the old seismic data with the new well control.

But this is a cheap method of exploration. The costly seismic work was done several years back. All that is required are a few electric logs, a knowledge of local and regional geology, and a geophysical background. One or at the most two men can review and coordinate a wealth of information. Total cost for a comprehensive review program can be less than $5,000 per month, this would pay for two experienced review men, either geologists or geophysicists, but preferably a team. In addition the $5,000 would take care of the overhead such as drafting, maps, electric logs, etc.

Worcester field . . . Good Luck Oil Co. had shot seismic line A-A' across Worcester field shortly after it was brought in. The original interpretation showed no faulting northwest of the discovery well, the 1 Henry.

The 1 Jones, a recently abandoned wildcat, had good shows in the "A" sand, but was finally plugged. Review of the old seismic line A-A' and coordination of the geological and seismic data showed that a reverse fault separated the 1 Smith and 1 Jones. Good Luck geologists recognized the possibilities of a commercial trap updip from the 1 Jones. They immediately recommended a carefully designed seismic program to map the inferred trap.

Subsequent shooting mapped about 600 ft. of closure against a reverse fault; Good Luck purchased available acreage on the prospect. Later drilling outlined 1,200 productive acres with recoverable reserves estimated at 12 million barrels.

Unconformities can completely mask the underlying complex geology. In West Texas, many Permian oil fields are low-relief anticlines; the pre-Permian structure frequently is exceedingly complex. This is true in other areas in the United States. The shallow structure does not always reflect the deeper subsurface conditions.

Deeper production on these structures is a very important source of oil. Too often the deep test is drilled on the crest of the shallow structure, and the result is a dry hole that supposedly condemns the deeper pays. But geophysical work can help eliminate these costly dry holes.

Overthrust fold . . . Operators wanted to drill a deep Madison test on a sharply folded foothills anticline. (Fig. 4-A.) Several shallow wells showed that the structure persisted at depth, but geologists suspected that the fold was an overthrust anticline. (See section A-A', Fig. 4-B.)

Detailed shooting along line B-B' revealed that the crest of the structure shifted to the northeast with depth. As a consequence, the deep test was located on the northeast flank ⅜ mile from the crest of the shallow structure.

Less than 1 week of shooting showed that the fold was overturned. Later drilling by another oil company supported the seismic interpretation when a well drilled several thousand feet of vertical beds before it was abandoned.

Subsurface Leads

Oil companies are lowering their sights and are drilling prospects today that were considered too small or uneconomic 10-15 years ago. This means that detailed geological reviews of old areas will uncover many prospects. Some of these may exist only in the mind of the geologist, but a great many of the subsurface leads warrant further attention.

The question arises, "How can an oil company differentiate between a good subsurface lead and a bad one?"

Geophysical work is an effective way of processing these potential oil fields. A few miles of shooting will confirm or wipe out most subsurface prospects. Contract crews will take these jobs on a fixed cost per shot hole basis. One Wichita firm has a price of $85 per hole, for example. This means 1 mile of shoot-

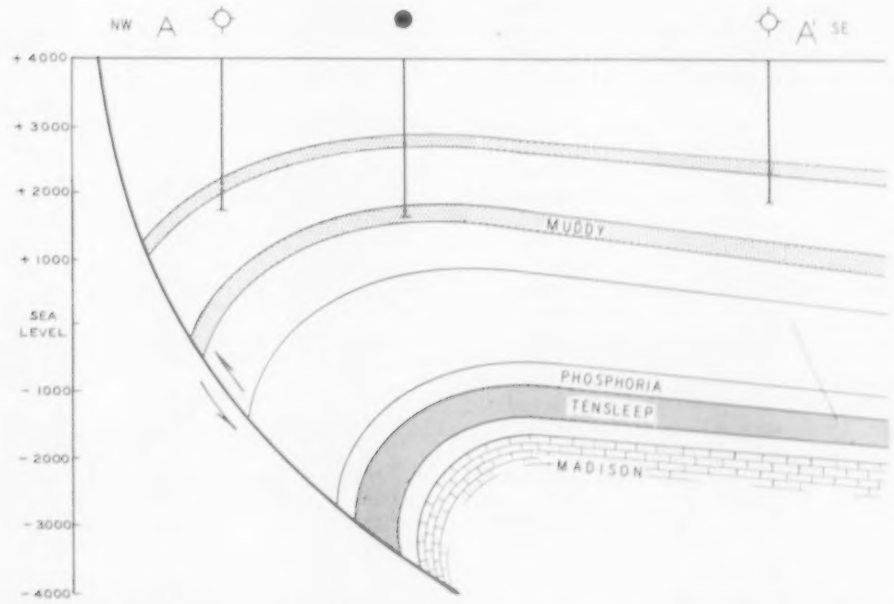


Fig. 4B—A geological interpretation indicated that the crest of the deep structure was almost 2,500 ft. northeast of the crest of the surface feature. Seismic line (Fig. 4A) and later drilling confirmed this conclusion.

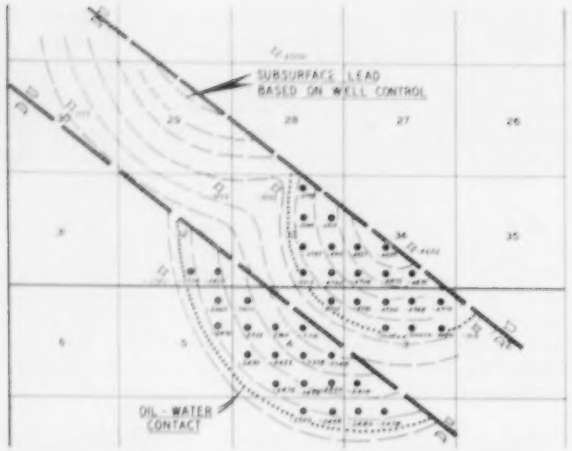


Fig. 5A—A study of old producing area is an inexpensive way of finding possible leads. These can then be checked with detailed seismic work.

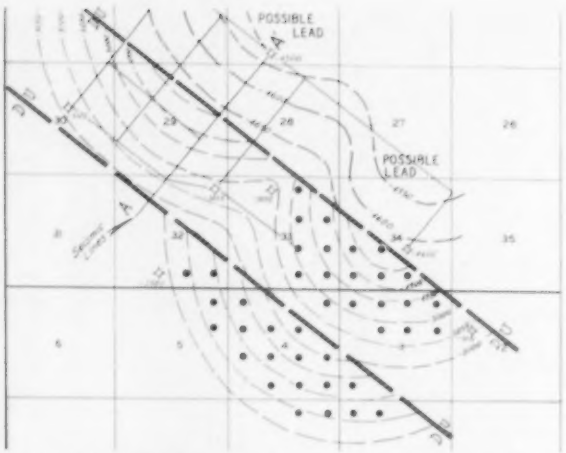


Fig. 5B—Later shooting supported the subsurface lead shown in Fig. 5A; in addition two attractive leads were uncovered.

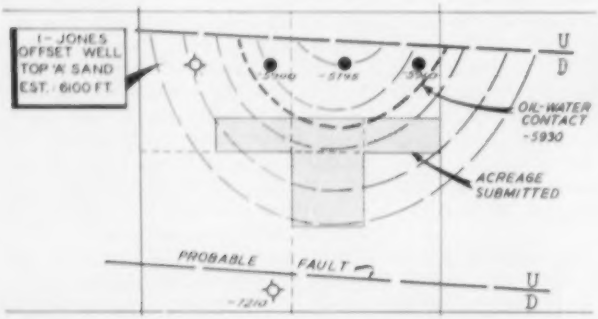


Fig. 6A—This interpretation offered little hope for production from the acreage submitted.

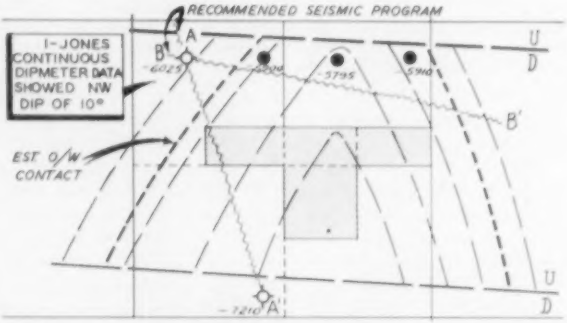


Fig. 6B—Continuous dipmeter data showed that the previous interpretation (Fig. 5A) was incorrect; A. & B. Oil Co. took the submittal subject to a test in 90 days; seismic lines A-A′ and B-B′ supported the revised map.

ing will cost $450 to $850 depending upon the type of shooting desired. The cost of a $6,000-ft. dry hole can exceed $100,000. Three miles of seismic lines are cheap insurance; and a prospect backed with seismic work is an easy one to sell.

... Zenith Oil Co. geologists had mapped a subsurface lead after studying an old producing area in detail; they recommended a detailed seismic program that was tied to key dry holes surrounding the prospect. (Fig. 5-A.)

Only 13 miles of seismic lines were needed to outline and confirm the fault closure. In addition, the survey uncovered two attractive seismic leads that Zenith plans on shooting. Total cost of the seismic program was less than $10,000.

Processing Submittals

Geologists should consider seriously any and all submittals crossing their desks. Of course, it is easy to have a mental rubber stamp marked "Reject" for every one of these details. The beauty of this approach is that 9 times out of 10, the submittal should be rejected. But the tenth deal may represent a million barrels of oil, or even 10 million barrels, depending upon the area.

Many submittals are open-and-shut cases; they are either good or bad. It is the borderline cases that require detailed study, and these should be approached with an optimistic but critical eye.

A deal may be worked out to check the prospect prior to drilling by exercising a geophysical option. Or possibly additional subsurface data such as a continuous dipmeter survey will place the submittal in a more favorable light. For these reasons each submittal should be considered carefully on its own merits.

... A small operator submitted 100 acres to A. & B. Oil Co., subject to a 7,000-ft. test within 90 days plus a one-sixteenth override. The original geological interpretation (Fig. 6-A) condemned the submittal, but A. & B.'s geologist carefully reviewed the area.

The 1 Jones, a recent dry hole, ran low as was expected. The A. & B. geologist obtained a continuous dipmeter survey on the Jones well through a swap. The continuous dipmeter showed persistent northwest dip instead of southwest dip. The revised interpretation (Fig. 6-B) showed that the acreage submitted was well located on the structure.

A. & B. immediately took the submittal and shot two seismic lines as shown. Less than $5,000 worth of seismic work supported the revised geological interpretation. A. & B. ended up with 2½ net wells as result of the geological and geophysical work. (Fig. 6-C.)

Buying Areas

A buying area is the immediate goal of any oil finder. He has studied the area in detail, considered all possibilities, and finally concluded that conditions are favorable for oil accumulation. The final test, of course, is the bit. But at this stage of the game, the geologist has enough confidence in his own judgment to recommend buying acreage with an eye to drilling it at a later date.

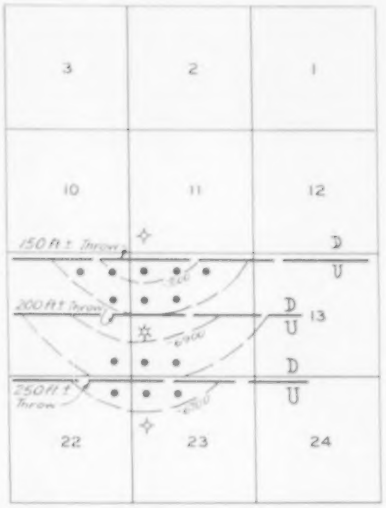


Fig. 7A—Dry holes had apparently outlined the limits of a South Louisiana field.

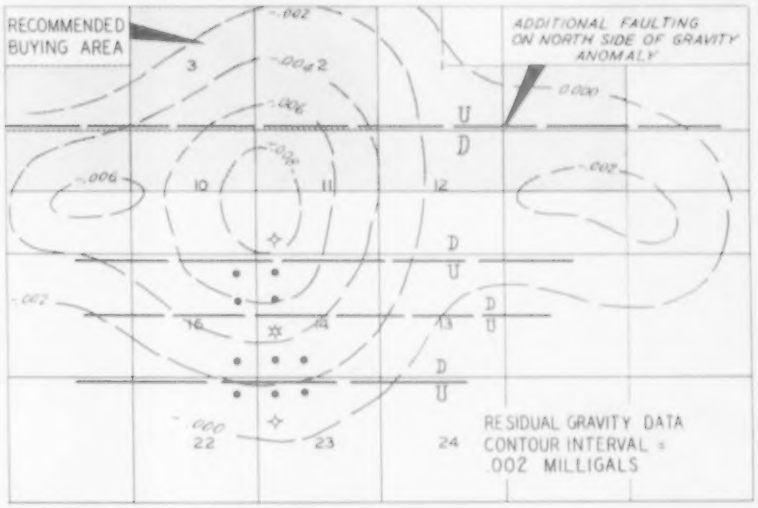


Fig. 7B—The residual gravity map showed a large anomaly indicating that additional faulting should exist.

Geophysical work is indispensable in outlining buying areas. If the prospect has been shot, it is a simple matter to sit down and make the necessary recommendation.

Gravity or magnetic work, however, can play an important role in finding more oil. These surveys must be related to local and regional geology to be of real value. Frequently such surveys can be used in outlining buying areas. The lead is then checked with seismic work prior to drilling.

Using gravity data . . . Production in a South Louisiana field was related to faulting; the limits of the field were fairly well defined dry holes and oil-water contacts. (Fig. 7-A.)

Geologists with X.Y.Z. Oil Co. studied the area and recognized that the field might be only the south half of a deep-seated salt dome or ridge. Deep-seated salt domes often have a graben over the center of the structure with production on each side of the graben that is controlled by faulting. (Fig. 7-B.)

A review of the gravity data supported this conclusion, because there was an elongate east-west trending anomaly just north of the producing area. (Fig. 7-C.)

X.Y.Z.'s geologist recommended a buying area along the north side of the gravity anomaly. Seismic work checked the postulated faulting; later drilling found several producing fault blocks as anticipated.

Subsurface Trends

"Trendology" plays a key role in finding new production. Certain types of fields follow definite trends or patterns. Once the pattern is recognized, seismic work can be used to extend the trend and find new oil fields. Here again, knowledge of local and regional geology is all important, and the seismic programs should be designed to fit the local conditions. In areas of steep dip, for example, it is foolish to use continuous loops, when dip shooting will give more reliable data.

. . . Pinchouts are another possibility for production and offer a real challenge to the geophysicist. In the past, many of these fields have been discovered by accident. Undoubtedly an all-out effort to map them will uncover more of these strat traps.

Rummerfield has proposed using reflection quality as one method of mapping pinchouts. *(See The Oil and Gas Journal, April 4, 1955, p. 278.)* Under favorable conditions, however, it is possible to outline the sand limits by mapping individual horizons. (Fig. 8.)

Outlook

The day of the large untested structure is past in mny areas. Oil companies are seeking stratigraphic traps and microstructures. They are turning to areas that in the past were considered too difficult or too expensive to shoot; they are culling over and reviewing older areas. In all of these programs, geophysics is indispensable.

Drillable prospects can still be found, but it requires the best efforts on the part of both geologists and geophysicists to find them today.

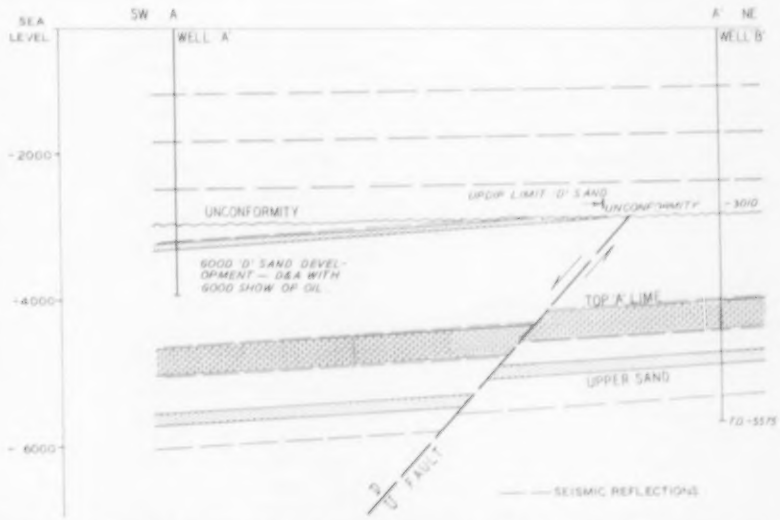
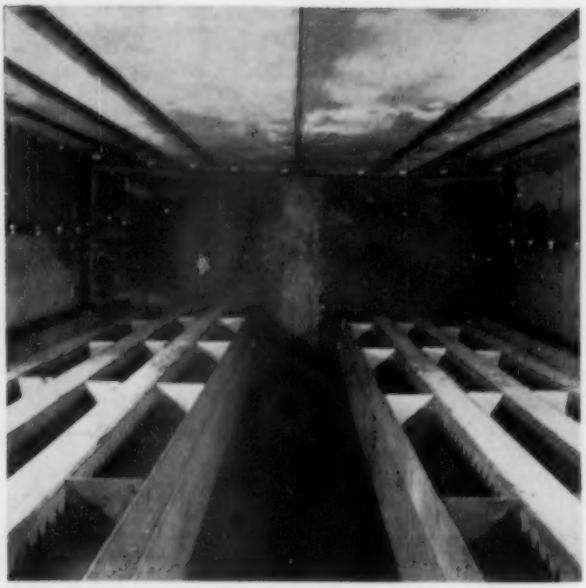


Fig. 8—A seismic line between wells A and B showed the updip limits of the D sand; in addition the line uncovered a possible fault trap between the two wells.



DOUBLE-CROSS UNIFLUX flow tray used for straightrun depropanizer. Tray diameter is 7 ft.

SINGLE-CROSS UNIFLUX flow tray used for amine absorption column. Tray diameter is 5 ft. 6 in.

Here's How Uniflux Trays Are Performing

Over 100 fractionating towers now use these trays, and efficiencies at least equivalent to those predicted for well-designed bubble-cap trays are probable

SOCONY Uniflux fractionating trays, which have been used exclusively for all of the planned fractionating-tray requirements of Socony Mobil Oil Co., Inc., for several years, are now finding wider and wider acceptance by the petroleum-refining industry for a large variety of fractionation requirements, including crude distillation, alkylation, stabilization, absorption, and stripping, to cite some of the more common applications.

There are over 100 fractionating towers employing Uniflux trays, all in successful operation and approximately 150 additional towers are being engineered or constructed which will employ these trays.

The entire fractionation requirements of two complete light-products refineries (General Petroleum Corp., Ferndale, Wash., and Standard Vacuum Refining Co., Ltd., Altona, Australia) are now being served by Uniflux fractionating trays. Both of these refineries went on stream during late 1954. They have experienced no difficulties of any kind whatsoever, insofar as fractionation is concerned and have observed excellent separations at all points from the outset.

Two more complete refineries, one in Turkey and one in Puerto Rico, employing Uniflux trays exclusively, will begin operation in 1955. Beyond this, Uniflux trays for other complete refinery installations are being contemplated. Besides the numerous single processing units employing these trays both domestically and abroad, Uniflux trays have been ordered as bubble-cap-tray replacements for several fractionating towers.

Tray Operation

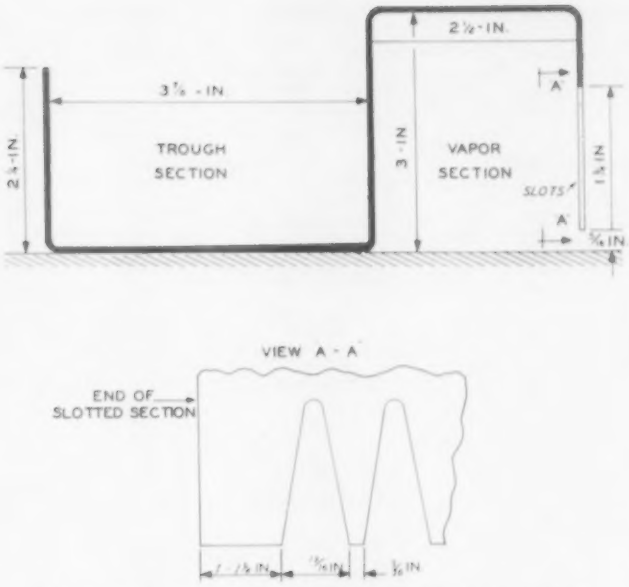
Socony Uniflux fractionating trays perform in much the same manner and have many of the same characteristics as conventional bubble-cap trays. Since the design of these trays combines functional and mechanical features, the tray is light in weight and therefore significantly less expensive than comparable bubble-cap trays. It is of such simple design that it can be rapidly installed in fractionating towers and easily removed if necessary for maintenance, inspection, and cleaning.

S-member . . . The fundamental unit of the Uniflux tray is the standard S-member. (See Fig. 1.) The vapor section of each S-member is enclosed at each end by vapor-closure pieces. Intermediate stiffeners are fastened at specified intervals in the trough section, to insure a good section modulus to the member, especially to the free wall of the trough section. These vapor-closure pieces and tray stiffeners are slotted so that on assembly the S-members are imbricated as shown in Fig. 2. Thus, the basic S-member has structural as well as functional properties.

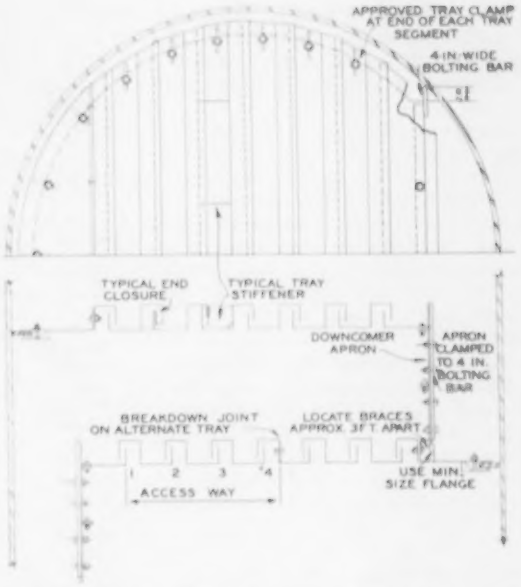
When fabricated of 16-gage material, it has ample strength to span a 10-ft.-diameter tower with negligible deflection under operating and maintenance conditions. In larger towers (up to 20-ft. diameter) a single intermediate support beam is used. No other support beams or purlins are required.

These S-members are secured to conventional support rings by a single tray clamp at each end. From the general assembly of a single crossflow Uniflux tray in Fig. 3 it may be seen that the S-members are assembled starting from the trough at the downstream side of the tray. The last vapor section is fastened to the vertical flange which is a part of the segmental section at the foot of the downcomer. For trays having more than seven S-members, a split S-member is provided on alternate trays so that vertical access is provided for maintenance, cleaning, and inspection.

Downcomers are similar to those of conventional bubble-cap trays. They



"S"-MEMBER is the fundamental unit of the Uniflux tray. Fig. 1.


APPROVED TRAY CLAMP AT END OF EACH TRAY SEGMENT
4-IN. WIDE BOLTING BAR
TYPICAL END CLOSURE
TYPICAL TRAY STIFFENER
DOWNCOMER APRON
APRON CLAMPED TO 4 IN. BOLTING BAR
BREAKDOWN JOINT ON ALTERNATE TRAY
LOCATE BRACES APPROX. 3 FT. APART
1 2 3 4
ACCESS WAY
USE MIN. SIZE FLANGE

TYPICAL TRAY SECTIONS used in Socony Uniflux fractionating trays. Fig. 2.

are standardized, however, with Uniflux trays and are so designed that unrestricted downflow is assured. For trays of very large downflow requirements the vertical flange of the segmental section at the inlet side of the tray is extended upward to provide a proper seal for the downcomer at the inlet to the tray. Double-crossflow trays employ the same basic S-member elements and are of similar design to the single-crossflow design.

Slot area . . . The tray parts are so proportioned that the available slot area is about 12 to 14 per cent of the superficial tower area, or generally equivalent to that provided in conventional bubble-cap-tray designs. Since the slotted sections are well separated, there is no interference of the vapors issuing from one slotted element with those issuing from another and the entire length of the slotted sections is fully effective. Furthermore, the vapors issue forth in one direction and in such a manner as to boost the liquid across the tray and compensate for hydraulic gradient under all conditions of flow. Therefore, running slot submergence is uniform across the tray.

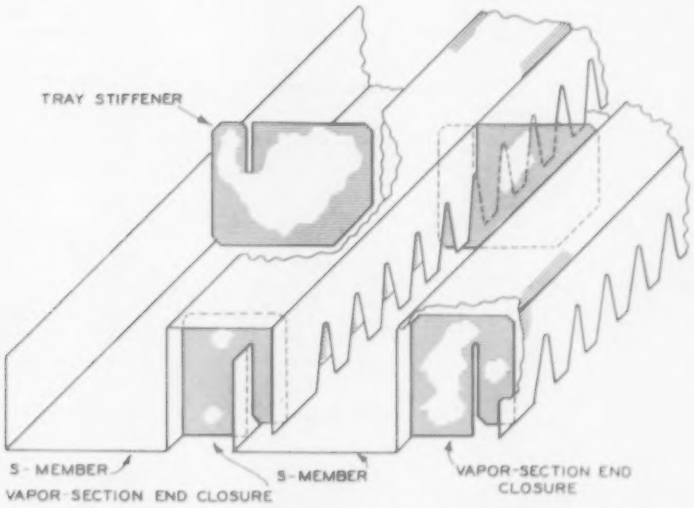
Since the Uniflux tray has no floor, such as is typical of bubble-cap trays, but consists of a series of submerged weirs, the phenomena of recycling and of bypassing which are commonly observed with bubble-cap trays do not occur and losses in efficiency resulting therefrom are eliminated. Riser area in general averages two to four times the riser area provided in bubble-cap-tray designs. Likewise, reversal area and equivalent annular area are large. Therefore, the Uniflux tray is characterized by low pressure drop.

From data developed to date it appears evident that the combination of equal slot submergence (compensated hydraulic gradient), low pressure drop and elimination of bypassing and recycling have resulted in measurable performance advantages.

Socony Uniflux trays are commonly fabricated of 16-gage 12-chrome material and weigh, complete with downcomers, about 8 lb. per sq. ft. of superficial tower area. Fabrication is simple and can be accomplished with standard press brakes, shears, and die-stamping equipment found in many light-metal shops.

Performance . . . The performance of Uniflux fractionating trays since the outset has been quite uneventful and entirely free of such difficulties as are characteristic of the usual new development. Consequently a large number of towers have been put into service and few commercial data have been available until recently. In the tabulations herewith, however, may be found summaries of commercial performance for several fractionating towers employing Uniflux trays.

Tables 1, 2, and 3 summarize the Uniflux tray performance of certain of the fractionating equipment in an alkylation unit recently installed in a



ASSEMBLY AND ELEVATION plans for the Uniflux tray unit. Fig. 3.

plant of Ohio Oil Co., by Ralph M. Parsons Co. All of the towers in this unit employ Uniflux fractionating trays but operating data are available only on the three reported here. In all cases the data presented represent average results of a 10-day acceptance-test run.

The deisobutanizer performance described in Table 1 indicates that this tower was doing the equivalent of 58 theoretical trays with 60 actual trays installed. The fact that the tower was loaded approximately 90 per cent at the top and only 36 per cent at the bottom suggests that somewhat greater efficiency could probably have been obtained if somewhat less feed preheat had been employed. The tray efficiency of approximately 96 per cent is probably not unheard of for a tower of this diameter (approximately 7 ft. 6 in.) but it is nonetheless good.

The tray performance of the 3-ft. alkylate debutanizer shown in Table 2 is also very satisfactory. However, no attempt was made to calculate the efficiency of the trays in this tower because the normal butane content of the bottoms was not reported. The 130° F. initial boiling point of the light alkylate and the over-all material balance suggest that the normal butane content of the debutanizer bottoms must have been very low but since no quantitative determination was indicated this efficiency was not calculated.

The 36° gap (Table 3) indicated between the light and the heavy alkylate separated in the rerun tower is considered very satisfactory for the reflux ratio and number of trays involved. Such a gap indicates that the true-boiling-point overlap of these materials must be very small. In summation the 94 per cent isobutane recycle purity combined with the 98 per cent composition of the normal butane reject and the large gap between the light and heavy alkylate suggest a high standard for alkylation-plant fractionation performance.

Feed preparation . . . Table 4 summarizes some test information obtained during the operation of a catalytic reformer feed-preparation column proc-

TABLE 1—ALKYLATION DEISOBUTANIZER

Tray Description

Type of operation	Deisobutanizing
Tower diameter	7 ft. 6 in.
Tray type	8 Section DXF
No. of trays	60

Operating Conditions

Flow—	Feed	Bottoms	Overhead	Reflux
Bbl./stream day	4,836	1,595	3,245	15,990
Moles/hr.	625	163	462	2,280
Temp., °F.	*202	†337	135	118
Press., psig.			115	
Stream compensation, mole per cent:				
Propane	2.3		3.1	
Isobutane	69.3	0.1	94.0	
Butene	0.1	0.2		
n-Butane	7.9	25.2	1.7	
Isopentane	1.0	0.2	1.2	
Lt. alkylate‡	18.0	69.0		
Hvy. alkylate	1.4	5.3		
Totals	100.0	100.0	100.0	

Calculated Results

Vapor loading, per cent of allowable:	
Top	94
Bottom	36
Reflux, L/D:	
Min. theoretical§	2.9
Actual	5.4
Boil-up ratio, V/W	5.7
Min. theo. trays at infinite reflux	37.7
Tray efficiency	96.5

*Feed preheated by steam from 85° to 202° F. †Heater outlet temperature: bottoms product temperature 283° F. ‡Isopentane content of alkylate was not reported. §Isopentane in overhead taken as n-butane.

TABLE 2—ALKYLATION DEBUTANIZER

Tray Description

Type of operation	Debutanizing
Tower diameter	3 ft. 0 in.
Tray type	2 Section SXF
No. of trays	30

Operating Conditions

Flow—	Feed	Bottoms	Overhead	Reflux
Bbl./stream day	1,595	1,306	289	684
Moles/hr.	163	121	42	99
Temp., °F.	*283	297	127	83
Press., psig.			70	
Stream composition, mole per cent:				
Isobutane	0.1		0.3	
Butane	0.2		0.8	
n-Butane	25.2		98.0	
Isopentane	0.2		0.9	
Lt. alkylate†	69.0	92.8		
Hvy. alkylate	5.3	7.2		
Totals	100.0	100.0	100.0	

Calculated Results

Vapor loading, per cent of allowable:	
Top	40
Bottom	30
Reflux, L/D	2.5
Boil-up ratio, V/W	0.75

*Deisobutanizer bottoms temperature. †Isopentane content of alkylate was not reported.

TABLE 3—ALKYLATION RERUN

Tray Description

Type of operation	Alkylate rerun
Tower diameter	4 ft. 6 in.
Tray type	4 Section SXF
No. of trays	20

Operating Conditions

Flow—	Feed	Bottoms	Overhead	Reflux
Bbl./stream day	*1,375	*197	1,178	410
Moles/hr.	125	13	112	39
Temp., °F.	†297	393	234	85
Press., psig.			1	
Stream inspections—				
Gravity, °A.P.I.	50.5	70.2		
A.S.T.M. dist., °F.:				
I.b.p.	358	130		
10 per cent	365	176		
30 per cent	371	205		
50 per cent	378	220		
70 per cent	388	230		
90 per cent	445	246		
E.p.	524	322		

Calculated Results

Vapor loading, per cent of allowable:	
Top	77
Bottom	56
Reflux, L/D	0.77
Boil-up ratio, V/W	9.5

*Feed includes 69 bbl./stream day recycled heavy alkylate—net heavy alkylate 128 bbl./stream day. †Debutanizer bottoms temperature.

TABLE 4—CATALYTIC REFORMER FEED PREPARATION

Tray Description

Type of operation	Straightrun gasoline fractionation
Tower diameter	7 ft. 6 in.
Tray type	10 Section SXF
No. of trays	30

Operating Conditions

Flow—	Feed	Bottoms	Overhead	Reflux	Feed	Bottoms	Overhead	Reflux
Bbl./stream day	5,741	2,610	3,131	3,276	5,699	2,595	3,104	2,044
Temperature, °F.	217	330	215	131	220	324	220	136
Pressure, psig.		16				16		
Stream inspections:								
Gravity, °A.P.I.	65.4	56.1	73.9		64.8	56.1	74.3	
A.S.T.M. dist., °F.:								
I.b.p.	106	252	93		110	247	94	
10 per cent	154	260	125		158	257	126	
30 per cent	196	265	151		198	264	152	
50 per cent	225	271	171		227	270	172	
70 per cent	250	280	186		253	279	188	
90 per cent	284	296	200		288	297	204	
E.p.	336	334	232		330	328	243	

Calculated Results

Vapor loading, per cent of allowable:		
Top	80	63
Bottom	79	55
Reflux, L/D	1.35	0.87
Boil-up ratio, V/W	2.7	1.9

TABLE 5—THERMAL GASOLINE DEBUTANIZATION

Tray Description

Type of operation	Debutanization	Debutanization
Tower diameter	3 ft. 0 in.	3 ft. 0 in.
Tray type	2 Section SXF	2 Section SXF
No. of trays	30	30

Operating Conditions

Flow—	Feed	Bottoms	Overhead	Reflux	Feed	Bottoms	Overhead	Reflux
Bbl./stream day	1,627	1,436		891	1,722	1,557		442
Moles/hr.	171	139	32		181	151	30	
Temperature, °F.	70	336	125	108	63	341	128	110
Pressure, psig.		104		96		100		95
Stream composition, mole per cent:								
Acid gases			0.3				0.2	
Methane	0.6		2.9		0.5		2.9	
Ethene	0.2		1.0		0.1		0.6	
Ethane	2.5		13.3		1.9		11.8	
Propene	1.5		8.0		1.3		8.0	
Propane	5.8		31.3		5.6		34.1	
Isobutane	0.9		4.8		0.8	Trace	5.0	
Butenes	2.9	0.4	14.3		2.8	0.8	13.4	
n-Butane	5.2	0.9	23.9		5.0	1.3	23.5	
Isopentane	3.0	3.7	0.2		2.8	3.3	0.4	
Pentenes	5.7	7.0			5.3	6.3		
n-Pentane	5.8	7.1			5.4	6.4		
Hexanes plus	65.9	80.9			68.5	81.9		
Total	100.0	100.0	100.0		100.0	100.0	100.0	

Calculated Results

Vapor loading, per cent of allowable:		
Top	39	22
Bottom	38	18
Reflux, L/D:		
Min. theoretical	1.2	1.2
Actual	4.3	2.3
Boil-up ratio, V/W	0.8	0.4
Min. theo. trays of infinite reflux	10.4	8.1
Tray efficiency, per cent	48	46

essing light straightrun gasoline at the Augusta, Kans., refinery of Socony Mobil. This tower was originally designed to obtain a 0° F. gap between the end point of the overhead and the initial of the bottoms at a reflux ratio of 1.0. In actual practice the data indicated in the first four columns on Table 4 indicate a 20° gap between the initial of the bottoms and the end point of the overhead.

A true-boiling-point distillation on these same samples under this condition indicated a true-boiling overlap of about 1 per cent. During a companion test run (see the second four columns of Table 4) this operation was conducted at a lower reflux ratio (0.65) and the gap between overhead and bottoms products was reduced to approximately 5° F. The t.b.p. overlap obviously in this case was considerably greater. Although no attempt was made to calculate the tray efficiency for this operation because of the complex system involved, it is probably high.

The data summarized in Table 5 were taken during a test period, while thermal gasoline was being charged to the debutanizer designed for a 3,000-bbl. per stream day catalytic reformer. Since this tower was very amply rated at 3-ft. 0-in. minimum diameter for the design requirements of the reformer and since less than 2,000 bbl. per stream day of unstable thermal gasoline were available, the two test periods summarized indicate very low vapor loading, especially the period at the lower reflux ratio. Additionally, the feed-point location was adverse for the thermal debutanizing test operation.

Crude distillation . . . Fragmentary data from an atmospheric crude distillation unit which commenced operation in the fall of 1954 is summarized in Table 6. This distillation unit is located in the Ferndale refinery of General Petroleum Corp. where, incidentally, Uniflux trays are now in service in all of the distillation columns in this new 35,000-bbl. per stream day light-products refinery. Because of technical manpower limitations during the early stages of this refinery operation it has not been possible to secure all of the data required to permit the determination of tower heat and material balances to facilitate the determination of vapor loadings and tray efficiencies.

It is estimated that the vapor loading in this tower is in the range of 60-80 per cent of the normal design allowable. The distillation overlap between the overhead and the sidecuts (see Table 6) indicate fractionation performance considerably superior to that in other Socony Mobil atmospheric distillation units employing a variety of different types of bubble-cap trays. It is expected that fractionation will improve as this tower is operated at more nearly the design throughput conditions.

Cost . . . The Socony Uniflux fractionating tray is being made available to industry on the basis of $1.00 per sq. ft. of superficial tower area per tray. Fabricators are licensed to construct Socony Uniflux fractionating trays and this fee is included in the tray quotation by the fabricator.

TABLE 6—ATMOSPHERIC CRUDE DISTILLATION

Tray Description

Type of operation	Crude distillation
Tower diameter	13 ft. 6 in.
Tray type	20 Section DXF
No. of trays	†33

	B.P.S.D.	°A.P.I.	A.S.T.M. distillation					
			I.b.p.	10%	50%	90%	E.p.	Flash
Guico crude	26,550	33.4						
Gas								
Debut. gasoline	3,700	67.5	89	102	160	212	236	
Naphtha	2,930	50.0	243	255	271	301	344	
Stove oil	7,190	37.5	358	402	459	544	570	154
Gas oil	1,460	31.5	546	596	606	640	678	230+
Topped crude	11,460	20.3						
Canadian crude	30,600	40.0						
Gas								
Debut. gasoline	6,370	67.5	92	118	160	198	230	
Naphtha	4,830	50.8	250	272	300	340	366	
Diesel	6,310		376	430	471	570	612	172
Gas oil	2,270	*37.7	*380	*430	*494	*596	*630	170
Topped crude	11,260	22.9						

*Blend of diesel and gas-oil sidecuts. †Does not include four 12-ft. 0-in. 18 section DXF stripping trays.

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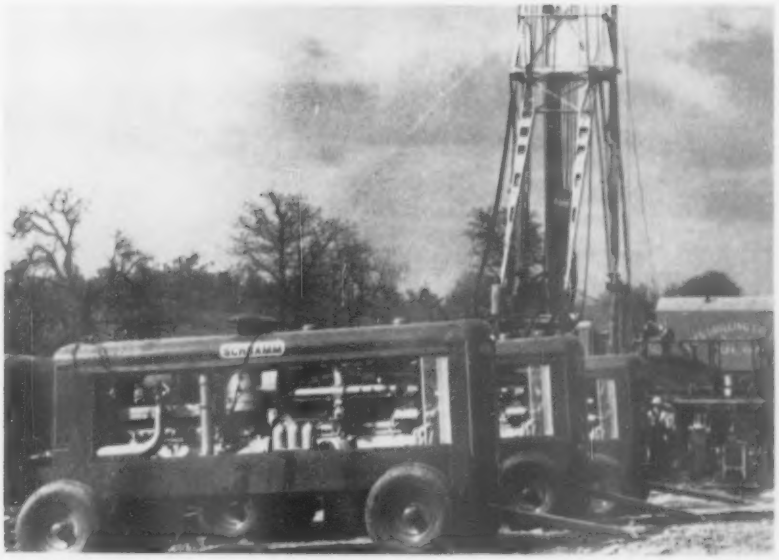


AN EXPERIMENTAL AIR TEST showed penetration rates as high as 120 ft. per hour and long bit life. Bit shown made 782 ft. and is still in good condition. Fig. 1.

Air Coring—New Boon to Water Flooders?

Test shows this tool may aid materially in evaluating leases more accurately

by Norman S. Morrisey

CORING with air may permit oil companies to evaluate water-flood leases more accurately. Results on a 1,600-ft. experimental test drilled by Reed Drilling Co., of Tulsa, for Keener Oil Co. were highly encouraging.

The test showed:

- Uncontaminated cores that could be used to help evaluate more accurately water-flood potential of the lease.
- Excellent core recovery using a diamond core head.
- Fast coring time of less than 2 minutes per foot.
- Over-all penetration rate of 65 ft. per hour, almost triple that of normal rotary holes in the area.
- Air drilling handled a troublesome water zone.
- Longer bit life.

In the past, cores from water-flood projects have been obtained by conventional methods using either rotary or cable tools. Operators desired more reliable core data than those obtained from mud-invaded cores in order to evaluate properly the water-flood possibilities of a lease. As a consequence, Reed Drilling Co., in conjunction with Keener Oil Co.; Schramm, Inc.; and Clarence Boyd, Inc., of Tulsa, set up an experimental test on Keener's Osage "A" lease, only 6 miles north of Tulsa. The main objective was to get clean cores from the Bartlesville sand found at about 1,500 ft. Operator took two cores, totaling 80 ft., and had 100 per cent recovery on the second core. On the first one, however, a defective core catcher caused the loss of 56 per cent of the core.

Analysis of the core (Table 1) compared favorably with cores from other wells on the lease. There was no contamination of the core; nor did it appear that the air temperature was high enough to strip the core of any light hydrocarbons as has happened on other air-coring operations.

Coring rate through the sand was less than 2 minutes per foot. Operators used a 6¾-in. diamond head with 8,000-13,000 lb. on the bit and a rotary table speed of 75-100 r.p.m. The air pressure averaged 175 psi. at the wellhead through the coring operations with 1,800 cu. ft. of air per minute. Oddly enough, the coring rate in shale was slightly less than that in the pay sand. Increasing the weight on the diamond core caused a pressure buildup, so operator increased the rotary table speed from 75 r.p.m. to 100 r.p.m. to improve coring time (Table 2).

The diamond bit showed some minor effects from sandblasting around the openings, but was in first-class condition after pulling the two cores. The matrix was worn away slightly but this probably improved the cutting rate.

Drilling . . . Reed Drilling Co. drilled the rathole and spudded with air and used calcium chloride to insure rapid setting of the cement on the surface pipe set at 44 ft. The total rotating time (hours on bottom) was only 22 hours and 7 minutes to the top of the pay at 1,489 ft., giving an average penetration rate of 65.16 ft. per hour. Occasionally it took less than 13 minutes between connections, with a penetration rate of better than 120 ft. per hour.

While drilling, operator carried 10,000 lb. on the bit and a rotary table speed of 70 r.p.m. Invariably, increasing the weight on the bit caused the air pressure at the wellhead to build up, so that it was necessary to vary the rotary table speed to step up penetration rates.

Three compressors delivered 1,800 cu. ft. of air per minute at the wellhead at a pressure of 75 psi. and this volume proved more than satisfactory. But experience may show that two

SAMPLES were caught at the flow line and when drilling with dry air were in good condition for microscopic examination (right). Fig. 2.

compressors can handle the job on these shallow 1,600-ft. holes, using the third as a standby or in reserve.

Only two bits were used below surface, 7⅞-in. 5-6 retips. The first bit made 782 ft. before it was pulled, but it was still in good condition (Fig. 1).

Equipment . . . Reed used a U-34 draw works mounted on a 96-ft. trailer mast, and 4-in. o.d. pipe with 5½-in. drill collars.

The compressed air was supplied by three separately unitized air compressors rated at 600 cu. ft. per minute each with a maximum pressure of 200 psi. These compressors were connected in parallel to insure volume capacity from each unit.

Cuttings . . . While drilling with dry air, cuttings reached the surface in about 10 seconds and were large enough for microscope examination (Fig. 2). The color of the exhaust dust was a good indication of the formation being drilled. A show of oil was encountered in a sand just below the Oswego lime and immediately the color of the exhaust dust changed from white to brown. A good odor was detected at the exhaust pipe and the well-site geologist was able to check the cuttings in a matter of minutes by the following procedure:

1. Drilling operations were temporarily suspended and the hole blown clean of cuttings.

2. Operator drilled 1 ft. into the zone and the geologist caught fresh samples at the end of the exhaust line.

Sample quality deteriorated rapidly after striking water, and it was impossible to identify cuttings. Satisfactory cuttings might be obtained by blowing the hole dry and then drilling ahead. Thus it might be possible to get dry samples in any desired interval.

SIMPLE INSTALLATION was used at the wellhead since there was little danger of a blowout. Fig. 3.

Drilling problems . . . Entry of water into the hole is the biggest problem to

TABLE 1—COMPARISON OF CORE ANALYSES FROM THE EXPERIMENTAL TEST AND A CABLE-TOOL CORE

	Core saturation				
	Porosity	Per cent oil	Per cent water	Perm. (md.)	Flood potential residual oil saturation
Oil sand:					
Air core	20.3	33	31	109	21
Cable-tool core	19.4	28	41	73	19
Oil-water sand:					
Air core	19.6	22	41	82	19
Cable-tool core	18.3	20	57	73	

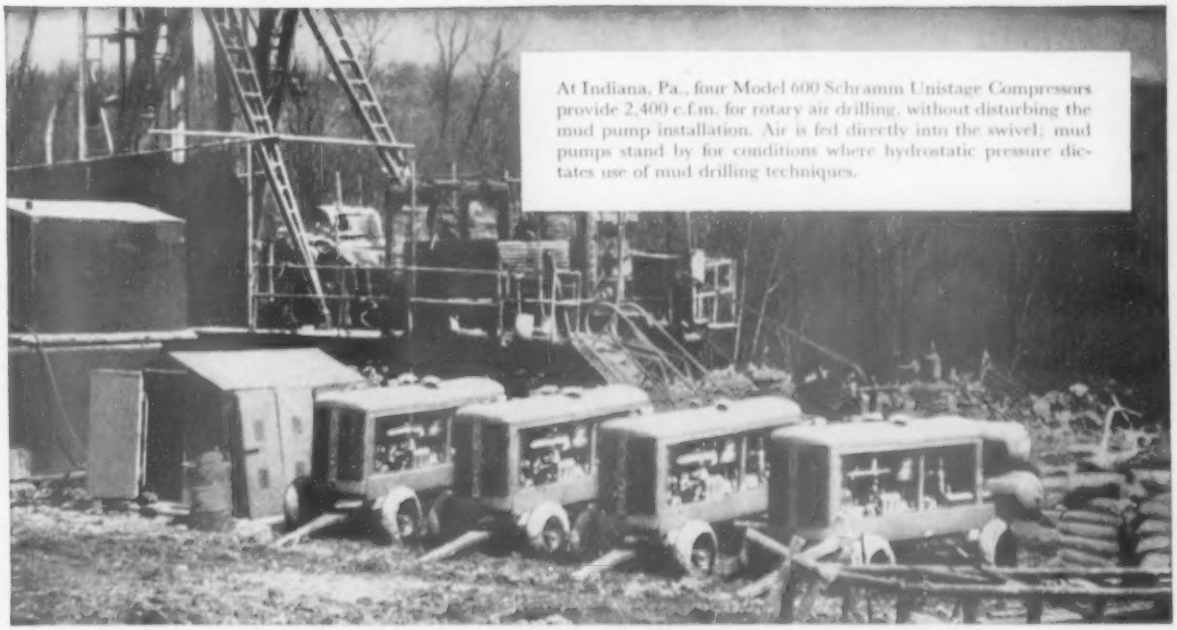
TABLE 2—EFFECT OF ROTARY TABLE SPEED ON CORING RATE

Rotary table speed (r.p.m.)	Air pressure (psi.)	Weigth on bit (lb.)	Cored interval (ft.)	Time (min.)	Coring rate (ft. per hr.)
75	175	12,000	7	14	30
80	185	10,000	24	50	29
85	175	13,000	17	29	35
100	175	13,000	6	7	52

TABLE 3—DRILLING PERFORMANCE DATA

	No. of bits	Drilling hours*	Feet drilled	Average ft. per bit	Average penetration rate (ft. per hr.)	Total time, spud to coring point (days)	Total depth
Experimental test, drilled with air	1½	22.1	1,489	990	65.16	2	1,569
Typical field well drilled with rotary tools using mud	4	66	1,450	362	22	5	1,550
Typical field well drilled with cable tools			1,500±			7½±	1,573

*Includes only hours on bottom, making hole.



At Indiana, Pa., four Model 600 Schramm Unistage Compressors provide 2,400 c.f.m. for rotary air drilling, without disturbing the mud pump installation. Air is fed directly into the swivel; mud pumps stand by for conditions where hydrostatic pressure dictates use of mud drilling techniques.

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Other advantages are reported daily from drilling crews. Cleaner, straighter holes. Absence of mud cake. Increased bit life—as much as 348%. Almost instantaneous examination of cuttings. Excellent core recovery. Lower cement requirements—better gauged holes.

Schramm Air Compressors can be installed on any standard mud rig in the field, without disturbing the mud pump installation. In conditions where hydrostatic pressure is needed, operation can be switched immediately to mud drilling operations. Actual installations of this type report air is being used for about 90% of the drilling.

The use of air instead of mud eliminates cost of water (about 300 bbl/day) and chemical mud (at about $1 per foot). And there are no lost-circulation problems when you drill with air. Air pumped into a hole is not reused; it makes no difference if the exhaust is in the hole or the atmosphere.

If you are not now using air for drilling, your drilling costs may be as much as 50% more than they should be. For further cost cutting information, write today. Ask for free booklets: "Rotary Rock Drilling with Schramm Air Compressors" and "Air Drilling in the Appalachian Basin." There is no obligation.

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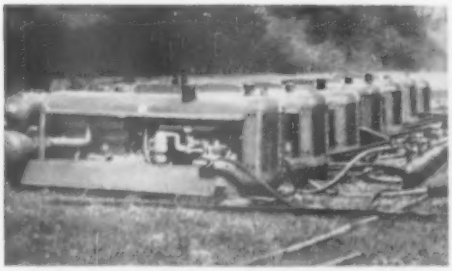

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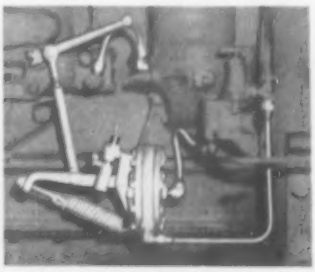

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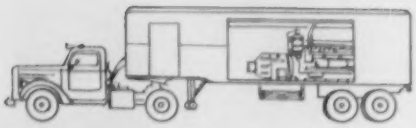

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overcome in air drilling. In Keener's experimental test a water seep was hit below the Oswego lime and it slowed down operations. The inflow of water formed a mud in the hole that threatened to stick the drill pipe; this mud also blocked the air from returning through the annulus between the wall of the hole and the drill pipe.

The water was successfully combated by adding water into the air stream. The added water formed a thin slurry that could be removed satisfactorily from the hole. Schramm representatives at the well pointed out that experience in other areas showed that a small seep of water was more difficult to handle than a steady flow. They stated that the air stream can handle large volumes of water under favorable conditions.

Dangers of a blowout in northeastern Oklahoma are not great, so Reed did not use a blowout preventer on the experimental test (Fig. 3). In the future, however, on deeper wells the company plans on using a rotating head and preventers.

Old methods . . . Both portable rotary rigs and cable tools are used in developing water-flood projects in northeastern Oklahoma. Many operators favor cable tools because the cores are cheaper to cut. But cable-tool cores are not too satisfactory for water-flood evaluation, so Reed and Keener experimented with air drilling as a possible answer to more reliable data and a cheaper and faster method of drilling these shallow wells.

Cable-tool wells require as much as 19 days to drill, clean out, and complete on the Keener Osage "A" water-flood lease. A recent test took 8 days to drill and core the Bartlesville pay sand compared to 4½ days on the experimental well. Cleaning out is slow and costly because Keener shoots the 50-60-ft. pay sand.

On the experimental test, 10¾-in. casing was run at 44 ft.; a 7⅞-in. hole was drilled to the top of the Bartlesville sand at 1,510 ft. The pay sand was cored for immediate analysis to determine the gas-oil contact. Operator then set casing below this contact and cored the Bartlesville to a total depth of 1,569 ft. Keener shot the pay zone with 1½ qt. per foot of pay and completed the well "barefoot." Gas injection wells normally have 4-in. casing and oil wells 5½-in., usually set below the gas-oil contact.

On the experimental test, the hole was in first-class condition and there was no trouble in running pipe.

"So I says, before I'll take less than a ten-thousand bonus on that tract, I'll go to work in a hamburger joint."

Structure . . . The Keener water-flood "A" lease covers 160 acres and is a pronounced topographic high with about 200 ft. of relief. Oddly enough, the surface high reflects the subsurface structure which has about 50 ft. of closure on the Oswego lime.

At least 80 ft. of sand above the oil-water contact will produce on parts of the lease, but the northeast 25 acres in the 160-acre lease are above the gas-oil contact and is nonproductive.

Originally, the production was controlled by a gas-in-solution drive typical of many of the Pennsylvanian sands in the Tulsa area. These sands respond readily to water-flood operations if the sand is porous and permeable. On the crest of the high, the oil-water contact occurs at about 640 ft. subsea; the contact is below 650 ft. subsea, only ½ mile east and north of the crest. (See USBM R.I. 5018, "Petroleum Engineering Study of Flat Rock Oil Field, Osage County, Oklahoma.)

Outlook . . . Probably the greatest hurdle to overcome in air drilling is the troublesome water zones that can slow down operations. On Reed's experimental test, it was possible to combat a small seep by adding water and drilling ahead. The returns, however, were unsatisfactory for microscope examination. In other areas, companies have combated these zones by squeezing. Several companies are conducting research along these lines; the sealing agent will probably be injected into the air stream and squeezed into the troublesome water zone.

Permian basin operators who are turning to air drilling feel that it is only a question of time until they can handle all but the very strongest water zones.

Low-pressure gas zones can prove a problem as there is the danger of an explosion. Carter Oil Co. has experimented successfully with the use of exhaust gases from the engines instead of air in Arkansas. Companies are investigating this further, particularly in an effort to design better filter systems.

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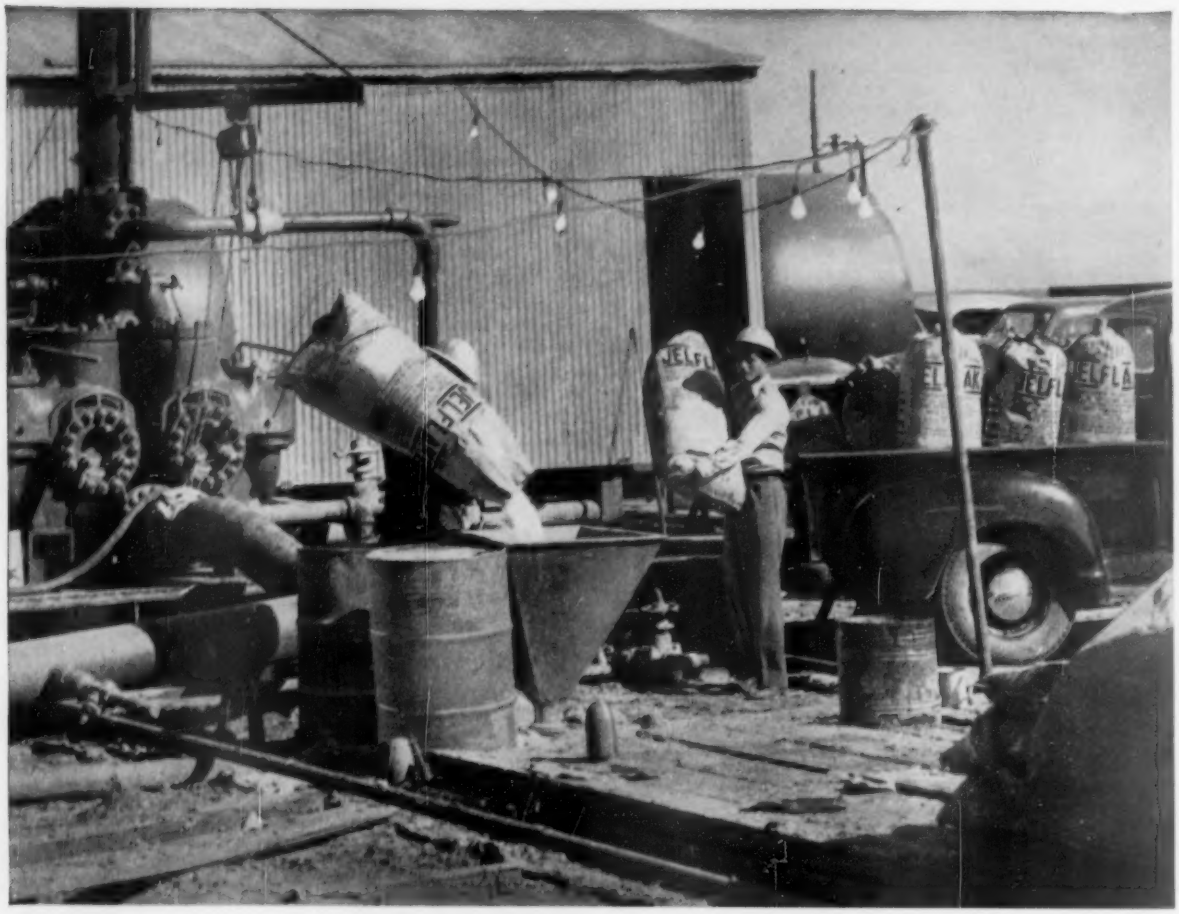

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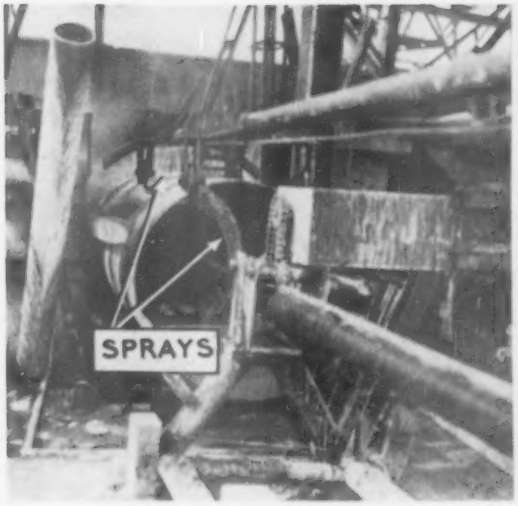
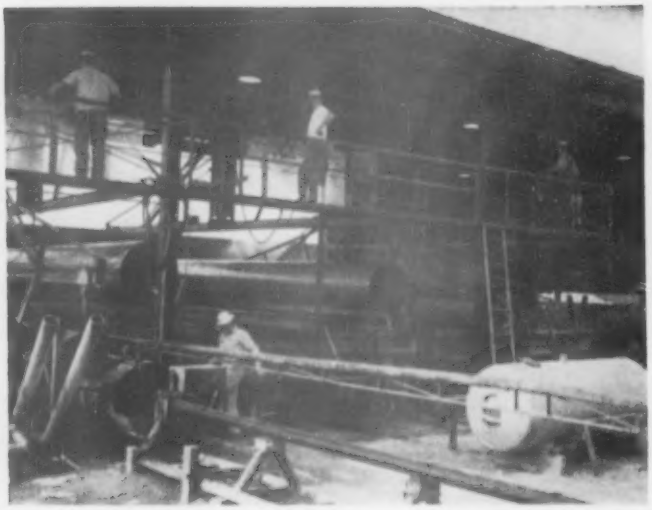


DUAL-BOOM arrangement sprays joint internally and externally following detergent bath in vat.



PIPE NEXT GOES through pickling sequence by immersion in series of vats. Spray boom for rinsing after detergent bath is in foreground.

Here's how

Transco Internally Coats 36-In. Pipe

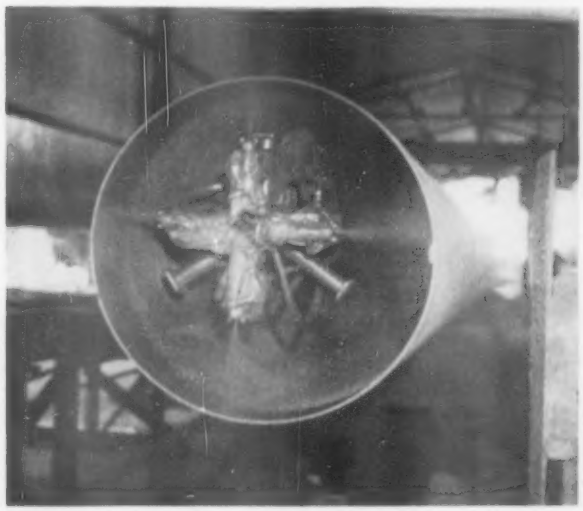
Industry eyes development with interest; improved efficiency is major purpose

by F. Lawrence Resen
Gulf Coast District Editor

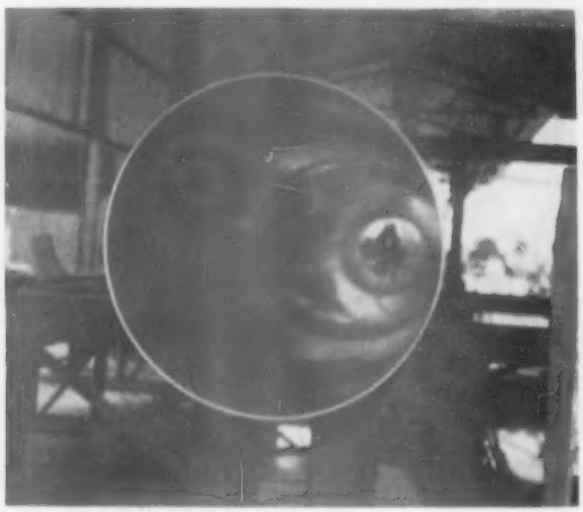
TRANSCONTINENTAL GAS PIPE LINE CORP. stepped out into the new year with the first major project involving 36-in. pipe. It is now lengthening its technological stride with an internal coating program on most of this pipe plus an internal coat on some 30-in. loops.

About 200 miles of 36-in. pipe and 80 miles of 30-in. pipe are being sprayed internally with an epoxy-based resin at the mill sites. This pipe is being laid in a current looping program which is costing $83,000,000 and which includes 534 miles of 30 and 36-in. pipe.[1]

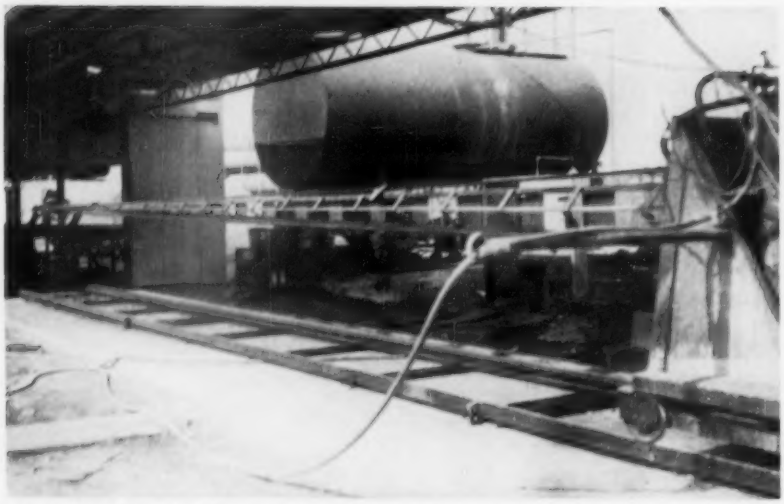
Transco has embarked on this coating program which it hopes will result



INTERNAL COATING of the 36-in. is done as this spray head is retracted from pipe. Pipe is rotated during painting.



FINISHED PIPE shows smooth interior finish. Chemical structure of epoxy resin makes it adhere well to pipe in a tough, flexible film.



PAINT SPRAY BOOM is 42 ft. long and mounted on rail-supported carriage. Rail at right is geared for smooth drive during coating.

in a cleaner pipeline; hence, a cleaner delivered product and lower maintenance costs. The odds are good that this will take place and that, additionally, the smooth internal coating will improve efficiency and performance of the system. It's still early in the game and the results won't be in until the line has been laid and operated. But if Transco's "experiment" pays off—and indications are that it should—it could quietly revolutionize the field of pipeline coating.

What's being done? . . . The coating is being applied at two mill sites where pipe is being rolled for the expansion program. The 36-in. pipe at Consolidated Western Steel Division's (U. S. Steel) Orange, Tex., plant is being coated with resin by Rosson-Richards Co. This coating is specially formulated by Coast Paint & Lacquer Co., Inc., Houston, and is based upon epoxy resins manufactured by Shell Chemical Corp.

Internal coating of the 80 miles of 30-in. was done by Crutcher-Rolfs-Cummings, Inc., at the Napa, Calif., plant of Kaiser Steel Corp. The method used there was previously described[2] and will not be amplified at this time.

The layout at Orange includes a series of ramps, vats, and the coating machine, which carry the pipe from the mill, move it through the pickling and coating operation and finally move it to a shipping point. Roller drives are used to move the pipe axially and inclined ramps serve to impart lateral motion. A triggered lifting mechanism raises the pipe joint above the axial rollers and starts it onto the inclined ramps.

Pickling . . . Individual pipe joints leave the mill and stack up on an inclined ramp adjacent to the pickling and coating operation. Equipment designed by Rosson-Richards is then used to process the pipe in a series of steps, as follows:

1. A newly rolled joint is picked up and placed in the first of several vats which contains an alkaline detergent solution for cleaning the pipe. At the same time, other joints are being picked up and progressively moved through the pickling operation. This is accomplished by six air hoists operated by four men stationed on an overhead runway. There is space for two 40-ft. joints in this first vat, and each remains immersed for about 30 minutes in the solution which is held at 160° F. Each vat has an inclined bottom so that as the preceding joint is removed, the following one will roll down leaving space to immerse the next joint in sequence.

2. After the joint has been immersed the proper length of time, it is picked up and placed on a rack adjacent to the vat. Here it is given a cold rinse and spray, both internally and externally. This is done by a double traveling boom which has a circular spray header on the lower member and an arc-shaped header mounted on the upper member. A geared rack is welded to the top of the lower boom, and power is imparted through a chain and gear drive to move the boom along the length of the pipe joint. As the unit starts its travel, water is pumped into the headers. The circular one passes through the pipe and sprays internally, and the arc-shaped one sprays over the outside of the pipe.

Rollers are used to support the upper boom head as it travels over the joint. A yoke-shaped affair is used at the end of the booms which extends outward to two automobile wheels which roll along the ground and thus support this end of the boom. Three idler rollers are also mounted along the boom assembly to help guide and support this end of the boom. The spray is used both as the booms travel inward and outward along the joint.

3. The joint is next picked up and placed in a second vat which contains a 9-12 per cent sulfuric acid solution heated to 150° F. This tank is 13 ft. wide and can hold four joints at a time. This permits each joint to remain a total of 7 minutes in the solution while preceding joints are progressively worked forward.

4. The next vat contains cold fresh water, and each joint is rinsed here. This vat is 7 ft. wide and holds two joints.

5. The last immersion is a phosphate solution having a concentration of 1.2 oz. per gal. A 3-minute immersion time at 180° F. prepares the pipe for the coating.

In the heated vats, a 6-in. flue runs along the bottom and gas jets are used to heat the solution. In addition, a live-steam line is connected so that steam may be turned directly into the solution and this affords an approximate method of controlling temperatures.

After being removed from the phosphate solution, the pipe is placed on an inclined ramp which feeds to the coating operation. The holdup time allows the pipe to dry, but does not cool it significantly. Thus, the pipe is still hot when being coated and this helps to hasten the drying of the resin.

Coating . . . A trigger is used at the lower end of the ramp to release one joint of pipe which then rolls onto the coating-step rollers. These are driven by an electric motor and spin the joint at 40 r.p.m., so that as the paint spray header passes through the joint all of the internal surface will be evenly coated.

The paint spray header consists of four spray guns mounted at 90° angles in an assembly supported at the end of a 42-ft. boom. This boom, which has been fabricated from pipe, channel iron, and flat bar, is attached at one end to a carriage which travels back and forth along a track. A geared rack is used to control the speed of the carriage at 40 ft. per minute. Power is supplied by an electric motor through an appropriate gear train.

The carriage contains auxiliary equipment such as paint supply drum, pump, motor drive, etc. The paint is pumped through a line attached to the boom and then distributed to the four guns through a manifold which has an individual fluid regulator for each gun. An air line also is attached to the boom, with air being carried to each gun. However, there is but one regulator

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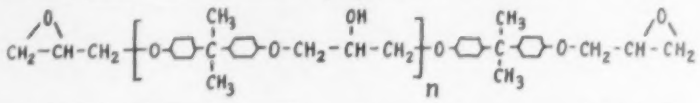
used, this on the main air line. A solenoid valve on the paint line controls the flow of paint to the guns.

In actual spraying operations, the boom is moved inward through the pipe joint. The joint is then rotated, and as the boom is withdrawn, the spraying commences. Each gun has a spray pattern 12 in. wide, and in effect four coats of paint are applied. Once the boom has been withdrawn from the joint, the joint is moved to a roller assembly which starts it on its movement through the yard to the loading area. During this movement the 1½-mil thickness of coating dries completely and uniformly.

The method used in California by Crutcher-Rolfs-Cummings varies somewhat from that described above. There, a rotating spray header was used as opposed to the rotating pipe. Also the pickling sequence was different, i.e., the steel plate was pickled prior to rolling.

What is the coating? . . . The epoxy resins used to coat the pipe are condensation polymers of epichlorohydrin and bisphenol. The structure of the polymer is below with the (n) repeating group determining various physical properties of the resin:



The unusual properties of the resin—excellent adhesion, chemical resistance and high flexibility—are attributed to the chemical structure. The only chain linkage other than carbon-to-carbon is an ether linkage. The chemical resistance of this bond in contrast with an ester linkage is extremely good. The reactive hydroxyl and epoxide groups are widely spaced along the chain so that curing agents, which crosslink the resin and make it thermosetting, are sufficiently far apart to give unusual flexibility in the cured resin. The polar nature of the molecule makes its outstanding adhesion possible.

In the particular application in spraying pipe where air drying is essential, the resin is normally formulated by the paint manufacturer into the spray coating to be used. Although these formulations will vary, a common one is the activation of the resin with small amounts of amines. This eliminates the need of baking the coating and facilitates its drying and curing in a normal atmosphere.

A typical amine solution by weight, as suggested by Shell, consists of 50 per cent of ethylene diamine, 17 per cent n-butanol, 17 per cent toluene, and 16 per cent water (from technical-grade amine). This is added to the base vehicle containing resin, a leveling agent, and solvents, just prior to applying the spray coat. Six parts by weight of pure ethylene diamine are added to 100 parts by weight of resin solids.

Film properties on such an unpigmented formulation have shown the following results after aging 7 days at room temperature prior to testing:

Pencil hardness, 4H.

Sward hardness, 33.

Tabor abrasion resistance, 16.6 mg. per 100 cycles.

Weathering (accelerated), unaffected in 1,000 hours; test continuing.

Exterior durability, unaffected in 3 months; test continuing.

Salt spray resistance, unaffected in 1,000 hours; test continuing.

Cold check resistance (—40° to 200° F. cycle), unaffected in 1,000 hours; test continuing.

Flexibility (bend test), unaffected by ⅛-in. bend.

Impact resistance, greater than 28 in.-lb.

30 minutes boiling water, unaffected.

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Passes 4 months immersion in: Hydrochloric acid, 36 per cent.

Passes 1 month immersion in: Acetic acid, 50 per cent; acetic acid, 5 per cent.

Will it work? . . . It is difficult to accurately evaluate the use of internal coating of gas lines and how it will affect the line efficiency. However, field tests conducted on liquid lines indicate that operation of the line should be improved. At the same time, an actual installation on a gas line—at the distribution end—resulted in a cleaner product and lower maintenance.

At Monahans, Tex., Texas Electric Service Co. coated some fresh-water lines consisting of 6,200 ft. of 6-in. pipe opening into an 8-in. pipe. Before cleaning and coating, flow was 186 g.p.m. at 180 psi. Pressure at the entrance to the 8-in. line was 40 psi. Pressure drop in the line was 68 psi. After cleaning and coating, flow was raised to 300 g.p.m. at only 66 psi. pump pressure. At the entrance to the 8-in. line, pressure was still maintained at 53 psi.—indicating a drop of only 13 psi.

Another test was conducted by Cabot Carbon Co. following coating of a fire line at the Hobbs, N. M., plant.[3] A 1⅛-in. nozzle was attached to the hydrant located farthest from the fire pump—about 1,950 ft. With the nozzle open and 125 psi. pressure at the pump, the flow meter showed the pump delivering 290 g.p.m. On previous tests made before the line was coated, only 190-g.p.m. flow could be obtained.

The following table shows the pressure readings obtained at hydrants at various distances from the pump as compared to calculated pressures. The calculated pressures are based on the normal drop through new 4-in. pipe delivering 290 g.p.m., which is 3.8 psi. per hundred feet:

FLOW TESTS OF 4-IN. FIRE LINE AFTER INTERNAL COATING

Distance of hydrant from pump (ft.)	Residual pressure at hydrants, psi.	
	Calculated	Actual
1,950	51	70
1,725	60	74
1,575	65	76
1,350	74	86
1,075	84	92

In West Texas, Humble Pipe Line Co. has approximately 225,000 ft. of pipe in its gathering system there which has been internally coated. Lines which had been coated had been experiencing leaks which declined sharply following this treatment. An example is Fuhrman-Mascho field, where over 100,000 ft. has been coated. The leak frequency in the field dropped from 0.69 leaks per mile to 0.07 after the lines were coated. This decline has occurred despite the fact that the facilities are getting older and leaks are developing in lines that have had no previous failures.[3]

Manufacturers Light & Heat Co., Wheeling, W. Va., coated a supply line from an underground storage field to a distribution center. Immediate result was the availability of clean gas without the need to clean the line. A more gradual result has been a marked decline in maintenance costs as clean gas—minus mill scale and rest—passes through the distribution systems.

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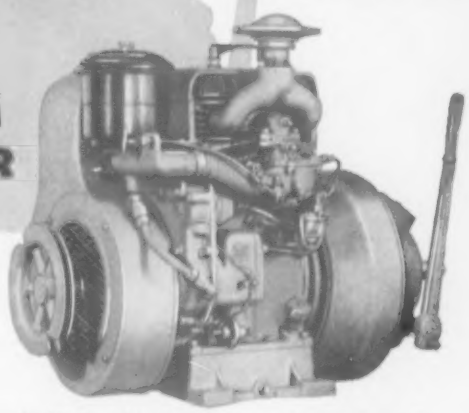

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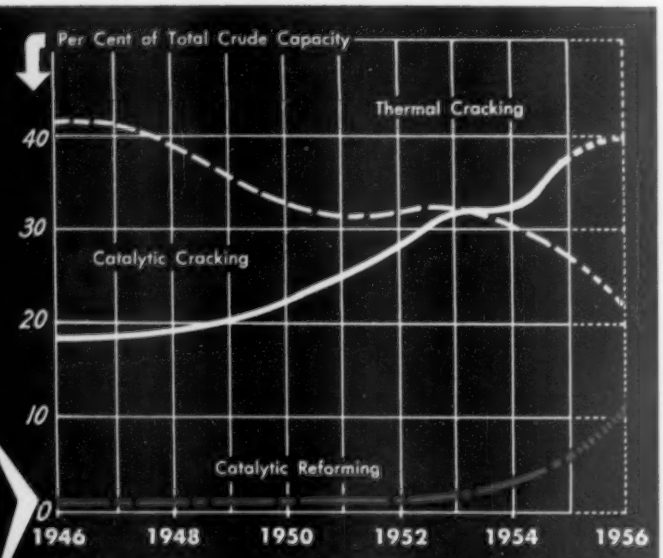

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TULSA TORONTO

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Refinery Stocks for Carbon-Black

This department was created for the purpose of aiding managers, superintendents, engineers, chemists, and all those engaged in various phases of plant operation, as well as those connected with the marketing and utilization of petroleum products. Readers are invited to submit their problems to W. L. Nelson, technical editor. Inquiries must be signed, but only the initials will be printed.

"You mention that carbon-black feed stocks should have characterization factors of 10.1-10.8. What refinery stocks have such factors?"—Wm. P. F.

Although scarcely any straightrun materials, even solvent extracts, have such low characterization factors as 10.1-10.8, the naphthenic or asphaltic crude oils are generally the best starting materials for the manufacture of carbon-black feed stocks. However, satisfactory materials can be produced from nearly all mixed-base or naphthene-base stocks.

Oils of 10.1-10.8 characterization factor consist almost totally of polynuclear aromatics or other highly condensed unsaturated ring structures. In addition, any side-chain attachments must be unsaturated. About the only refinery stocks that are suitable are those that result by thermal or catalytic cracking. Aromatic rings are thermally stable and they tend to pass through the cracking reaction and cracking plant without being destroyed. They finally accumulate in the cycle (or recycle) stocks and in the cracked residue (or fuel oil). Some aromatic rings are also produced during cracking, particularly in the extremely high-temperature vapor-phase cracking of gas oil (naphtha) or propane-butane.

Although cracking operations tend to produce concentrates of unsaturated aromatics, two practical difficulties arise:

1. The aromatic oils are produced in only small amounts.

2. The aromatic oils are often obtained as a mixture with other less cracked or uncracked oils.

Mixtures of aromatic and somewhat uncracked oils such as cycle stocks can, of course, be separated by means of solvent extraction, but this adds to the cost. It will be noted in Table 1 that even pure once-through catalytic cycle stock usually has too high a characterization factor to constitute a superior carbon-black feed. Pure thermal recycle stocks are superior but in most refineries the recycle stock is a mixture of cracked material and fresh feed.

Mixtures can be avoided or minimized in several different ways:

1. Thermal cracking of catalytic cycle stock. This automatically insures that no totally uncracked oils will be present.

2. Thermal cracking of a distilled feed stock which has a lower boiling range than the cracked residue. This insures that nothing but condensed structures produced during cracking will appear in the cracked tar or residue. Gas cracking (propane or butane) is an extreme example of this operation.

3. Coking of a very high-boiling feed stock (boiling above anything in the recycle stock) by introducing it through a cracking coil rather than into the fractionating tower or coke chamber. The recycle stock (cracked distillate) so produced can contain no uncracked material.

4. Operate at high recycle ratios and withdraw only a small amount of recycle (cracked distillate) stock. This tends to increase the proportion of cracked material in the recycle stock.

5. Catalytically crack at a high conversion and if possible by recycling rather than by once-through operation.

The main stocks are (1) cracked fuel oil from the thermal cracking of cycle stocks, or the vacuum flash distillate from such cracked fuel oil, (2) aromatic extracts from catalytic cycle stocks, and (3) thermal or catalytic cycle stocks. There are, of course, many other choice stocks but ones not ordinarily available in quantity such as ethylene plant tar, Hydroformer bottoms, and tars and

TABLE 1—APPROXIMATE CHARACTERIZATION FACTOR OF ONCE-THROUGH CATALYTIC CYCLE STOCKS

C.F. of feed stock	Characterization factors (C.F.) of cycle stocks for these conversions				
	40 per cent	50 per cent	60 per cent	70 per cent	80 per cent
11.0	10.34		(*)	(*)	
11.2	10.68	10.50	10.25	(*)	
11.4	11.10	10.90	10.73	10.2	
11.6	11.33	11.24	11.11	10.82	
11.8	11.6	11.51	11.36	11.19	10.75
12.0	11.74	11.66	11.52	11.37	11.06
12.2	11.82	11.72	11.59	11.43	11.18

*Apparently very good.

TABLE 2—PROPERTIES OF EXTRACTS PRODUCED BY THE SOLVENT TREATING OF CRACKED DIESEL FUELS

	Furfural extracts				Sulfur dioxide extracts			
	Pennsylvania	Mid-Cont.	E. & W. Tex.	California	Pennsylvania	Mid-Cont.	E. & W. Tex.	California
Feed:								
A.P.I.	30.1	28.1	30.3	30.7	30.1	20.1	30.3	30.7
Per cent sulfur	0.05	0.23	0.6	0.45	0.05	0.23	0.6	0.45
Carbon res.	0.02	0.14	0.10	0.06	0.02	0.14	0.10	0.06
Extract:								
A.P.I.	12.9-13.3	17-17.3	10.9-12.6	15.5-15.6	13.2-13.4	15.3-17.9	14.4-16.1	17.4-17.5
D. index	−0.1 to 0.4	−1.2 to 1.8	−0.3 to 0.9	−3.6 to −1.7	−4.8 to 0.5	−3.4 to 0	−2.9 to −1.6	−2.6
50 per cent b.p.	530-542	498	554-559	498-502	528	494	524-530	475
Per cent sulfur	0.02-0.05	0.01-0.04	0.09-0.15	0.04-0.1	0.12-0.18	0.74-0.84	0.29-0.31	0.27
C.I.*	95	86	95	92	96	92	89	92
C.F.*	10.2	10.4	10.2	10.25	10.15	10.25	10.3	10.25

*Approximate average.

cycle stocks from the vapor-phase cracking of distilled (gas-oil) feeds. In most carbon-black plants it is necessary to vaporize the oil feed and accordingly, a low boiling range is advantageous. However, thoroughly cracked materials, even residues, have relatively low boiling ranges, and little trouble is therefore encountered. Straightrun or lightly cracked residues have very high boiling ranges and so when considering residual stocks or tars, it is again useful to try and produce (or locate) a residue that is not a mixture of cracked and straightrun materials.

Table 2, which is a summary of the data of Dryer, et al. (Ind. Eng. Chem., 30, 813, July 1938) on the extraction of cracked diesel fuels, shows that solvent extracts are excellent carbon-black charge stocks. Meager data in the literature on catalytic cycle stock extracts indicate much the same, and perhaps even lower characterization factors (9.6-10.2).

Low-Cold-Test Crude Oils Are Rare

"We have many crude oils but most of them have too high pour points for producing low - cold - test lubricants. Is there any way to judge which oils are satisfactory, especially with new production?"—G.B.T.

There is really no way to be certain as to whether or not a crude oil contains low-cold-test lubricating oils except, of course, testing them in the laboratory. However, if Hempel analyses are available, many of the unsatisfactory oils can be eliminated from consideration by noting the gravities or more specifically, the characterization factors (specific gravity divided into the cube root of the absolute °F. boiling point) of Hempel fractions No. 10 (about 556° F.) and No. 14 or No. 15 (about 715° or 762° F.). Oils are not worth a laboratory examination if:

1. The characterization factor at 550° F. is below about 11.00 nor above 11.45.

2. The characterization factor at 750° F. is outside the range of 11.3-11.65. Below 11.3 the viscosity index of the lube is too low and above 11.65 the pour point is unsatisfactory.

Even the selected oils that meet the above requirements must be tested in the laboratory because many exceptions appear. Table 1 indicates all information available to this department concerning low-cold-test lube crudes. Specific information on Gulf Coast crude oils was not available but all of the Gulf Coast oils listed are ones purchased under Gulf Coast Schedule 1 (Grade A) low cold test. Some of the best known low-cold-test Gulf Coast crude oils are those of Goose Creek, Raccoon Bend, Hull, Humble, Spindletop, Sugarland, and Thompson. However, some of the samples from these fields are unsatisfactory.

TABLE 1—EXAMPLES OF THE PROPERTIES OF A FEW LOW-COLD-TEST LUBE CRUDES

A.P.I.	Name	Characterization factor		Properties of 700°-900° F. boiling range fraction	
		At 550° F.	At 750° F.	Pour point (°F.)	Viscosity index
14.0	Vermilion, Canada	11.28	11.42	0	35
14.8	Cabimas, Venezuela	11.3	11.37	0	17
15.0	Cabimas, Venezuela	11.4	11.35	—10	15
16.1	Tia Juana, Venezuela	11.38	11.4	— 5	15
17.3	Lagunillas, Venezuela	11.3	11.4	—10	11
17.2	Tia Juana, Venezuela	11.4	11.4	—15	22
19.4	Yopales, Venezuela	11.4	11.45	—15	24
20.5	Casabe, Colombia	11.42	11.4		
19.7	Spindletop (800 ft.)	11.08	11.28		
20.2	Los Olmos*	10.9	11.13		
20.5	Goose Creek (2,050 ft.)	10.96	11.31		
21.3	Goose Creek (2,000 ft.)	11.04	11.33		
20.3	Danbury Dome (2,600-2,900 ft.)	10.98	11.34		
21.0	Cabimas, Venezuela	11.5	11.55	—25	63
21.8	Esperson	11.21	11.62		
21.3	Hull† (old) (3,300 ft.)	11.2	11.42		
21.5	Port Neches	11.05	11.45		
21.1	Raccoon Bend	10.92	11.43		
22.2	Temblador, Venezuela	11.4	11.5	—25	25
24.0	Goose Creek (3,500 ft.)	11.08	11.43		
23.7	Orange† (3,680 ft.)	11.25	11.48		
24.0	Colombia lube crude			—25	23
23.7	West Columbia† (3,724 ft.)	11.08	11.55		
25.2	Batson† (old) (1,100 ft.)	11.1	11.47		
25.9	Dayton, North (1,700 ft.)	10.9	11.32		
25.6	Hull†	11.08	11.52		
25.2	Manvel† (Miocene)	11.21	11.68		
25.4	Pickett Ridge	11.0	11.55		
25.7	Tia Juana 102, Venezuela			—20	
25.8	Tia Juana 102, Venezuela	11.5	11.63	—15	40
26.0	Tia Juana 102, Venezuela	11.45	11.6	—25	28
26.1	Tia Juana 102, Venezuela	11.5	11.65		40
26.8	Blue Ridge (3,947 ft.)	11.2	11.41		
26.3	Goose Creek (4,350 ft.)	11.2	11.49		
26.8	Spindletop	11.0	11.41		
26.1	Thompson	11.1	11.58		
26.3	Withers, North†	11.05	11.58		
27.1	Beaumont, West†	11.43	11.74		
27.1	Clear Lake*†	11.28	11.60		
26.8	Hankamer	11.22	11.75		
27.5	Goose Creek	11.13	11.57		
27.0	High Island	11.28	11.68		
27.3	Lockridge	11.12	11.55		
27.9	Mykawa	11.17	11.62		
28.8	Nome	11.27	11.72		
28.6	Sour Lake (2,400 ft.)	11.16	11.39		
28.8	Sugarland sour	11.03	11.51		
28.4	West Columbia,† New Deep	11.2	11.62		
29.7	Amelia	11.2	11.65		
29.5	Raccoon Bend	11.2	11.75		
29.3	Webster (Friendwood)	11.43	11.75		
31.1	Fannett	11.27	11.71		
30.8	Spindletop	11.13	11.63		
33.4	Barbers Hill†	11.38	11.68		
32.1	Hastings†	11.42	11.78		
35.4	Segno*	11.52	11.91		

*Doubtful. Other samples may have better properties. †Other samples or oils from other formations not satisfactory.

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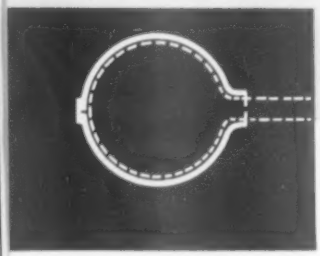

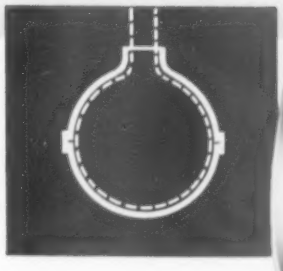

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Accuracy of McCullough Scintillation Counter Shown by Sharp Definition of Thin Beds

The McCullough Radiation Well Logger utilizes a very sensitive radiation detector—the highly efficient McCullough Scintillation Counter. It is a dense, transparent body that converts gamma rays and the energy from neutrons into light, called "scintillations."

This scintillation counter has an efficiency approaching 100% in its ability to detect radiation. Because of this efficiency the counter need only have an effective length of from 2 to 3 inches. Therefore, it will sharply define lithologic boundary changes and will clearly define thin beds.

A striking example of this efficiency is demonstrated by the following field report on a series of logs run in numerous wells in a Canadian oil field.

At one end of the field the main sand is water loaded except for top streaks. This top sand is about 12 inches thick with thin lenses of sand and shale over it. Usually a single string of 5½" casing is set through the pay zone which lies at approximately 3200'.

The perforator is positioned from McCullough Gamma Ray Log measurements and a simultaneous collar log. Usually one to three feet of zone are perforated with eight holes per foot. Shooting just a few inches too high means no production—a few inches too low results in water and hazardous squeezing operations.

The fine detail and extreme accuracy of the McCullough Log accurately pin points the thin sands for successful completion.

McCullough Radiation Well Log Finds Casing Set Too Low

Helps Turn a Three Year Old Abandonment Into a Profitable Completion

Converting an abandoned well into a flowing one was the subject of a recent job report from a McCullough Wyoming Branch Manager.

This well had been drilled about three years ago and had never been a producer. 5½" O.D. casing had supposedly been set on top of a sand formation that looked promising.

McCullough ran a Radiation Log to total depth and found that the casing had actually been set within six inches of the bottom of the sand. Nearly all the productive area had been cased off.

Using a combination of M-3 Bullet Guns and Super Casing Glass Jets, 120 holes were shot through the casing in a 15 foot interval at 3655'. The well started flowing immediately after perforating and has continued to be a good producer.

Jobs like this, where a total loss has been changed to a profitable completion, are a tribute to the extreme accuracy and efficiency of the McCullough Radiation Well Logger. However, equal credit for the production obtained must be given to the deeper penetrating abilities of McCullough Perforators.

Kernahan Appointed Canadian Sales Manager

G. M. Kernahan has been appointed Sales Manager of the Canadian Division of McCullough Tool Company according to an announcement by Norman Brookes, Canadian Division Manager.

Kernahan will operate out of McCullough's Calgary office, giving special emphasis to Radiation Well Logging and Bullet and Jet Perforating. He will direct and supervise sales operations in the rapidly expanding oil industry in Western Canada.

McCullough Radiation Well Logger locates formations of interest with pin point accuracy

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LOS ANGELES
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Maintaining Slush-Pump Fluid Ends—2

HOT mud decreases the effectiveness of the suction because, under the conditions of low pressure or vacuum existing in the cylinder on the suction stroke, this water, at a comparatively low temperature, may boil. This is exactly the same phenomena experienced at high altitudes. Thus, a mud temperature of 150° can present a critical suction problem. Furthermore, hot mud accelerates the deterioration of rubber parts, particularly when oil is present. Ample mud-pit cooling surface usually solves this problem.

Separating gas and air . . . Entrained gas and air expand under the reduced pressure of the suction stroke and lower the suction efficiency. Gas in water-base mud may also deteriorate the natural-rubber parts which are used for such service. Gases usually may be separated with baffles or by a change in mud composition.

Separating cuttings . . . The usual good lubricating qualities of mud can be lost if cuttings, particularly fine sand, are not effectively separated. Adequate settling pits and shale shakers usually eliminate this trouble. Desanders are used occasionally.

Discharge manifold . . . A poorly designed discharge manifold can cause shock waves and excessive pressure leaks. This manifold should be as short and direct as possible, avoiding sharp turns. The conventional small atmospheric air chamber, often furnished with pumps, supplies only a moderate cushioning effect. For best results this should be supplemented by either a large atmospheric air chamber or by a precharged pulsation dampener.

Pump Operation

Priming . . . A few strokes of a piston in a dry liner may ruin it, as shown in Fig. 5c. When the pump does not fill by gravity and when the cylinders have been emptied by standing or by piston and liner replacements, it is essential to prime the pump through the suction-valve cap openings.

Cleaning suction manifold . . . Suction lines are often partly filled by settling sand and by debris from the pits. This causes pump hammerating at abnormally low speeds. Frequent inspection and cleaning is required. The suction strainer can also be a liability if it is not cleaned frequently.

Cleaning the discharge strainer . . . The discharge strainer, a part which may become more useful with the smaller jet nozzles, often becomes clogged with pieces of piston and valve rubber. This causes an increased pump pressure in the pump which is not shown by the pressure gage beyond the strainer. Obviously, the strainer should be inspected and cleaned frequently.

Lost-circulation materials . . . Most of these materials can shorten pump-parts life. They are especially hard on valves and seats when they accumulate on the seats and between the valve body and the valve disk.

Parts selection . . . Parts should be selected with emphasis on proper pump operation as well as service life. This subject is discussed in detail under the various headings.

Parts storage . . . Satisfactory pump parts, to withstand hard high-pressure service, are precisely made of fine materials and should be treated accordingly. In storage at the rig, metal parts should be protected from rusting and physical damage. Rubber parts should be protected from distortion and from exposure to heat, light, and oil. Generally, parts should remain in their original packages where they are usually protected with rust-inhibiting coatings and wrappings and properly supported to avoid damage.

Careless stacking of pistons may distort or cut the sealing lips and result in early failures. Hanging lip-type or O-ring packings on a hook or throwing them carelessly into a bin may ruin them. Metal parts temporarily removed from pumps should be thoroughly cleaned, greased, and stored like new parts.

Storage of pumps . . . In storing a pump for an extended period, liners, pistons, rods, and valves should be removed and both the cylinder and the parts thoroughly cleaned and given a protective coating. Leaving parts in place, particularly liners, can result in excessive rusting and deterioration.

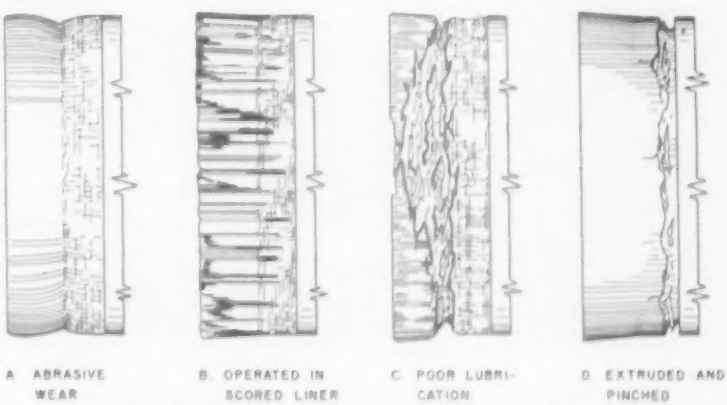
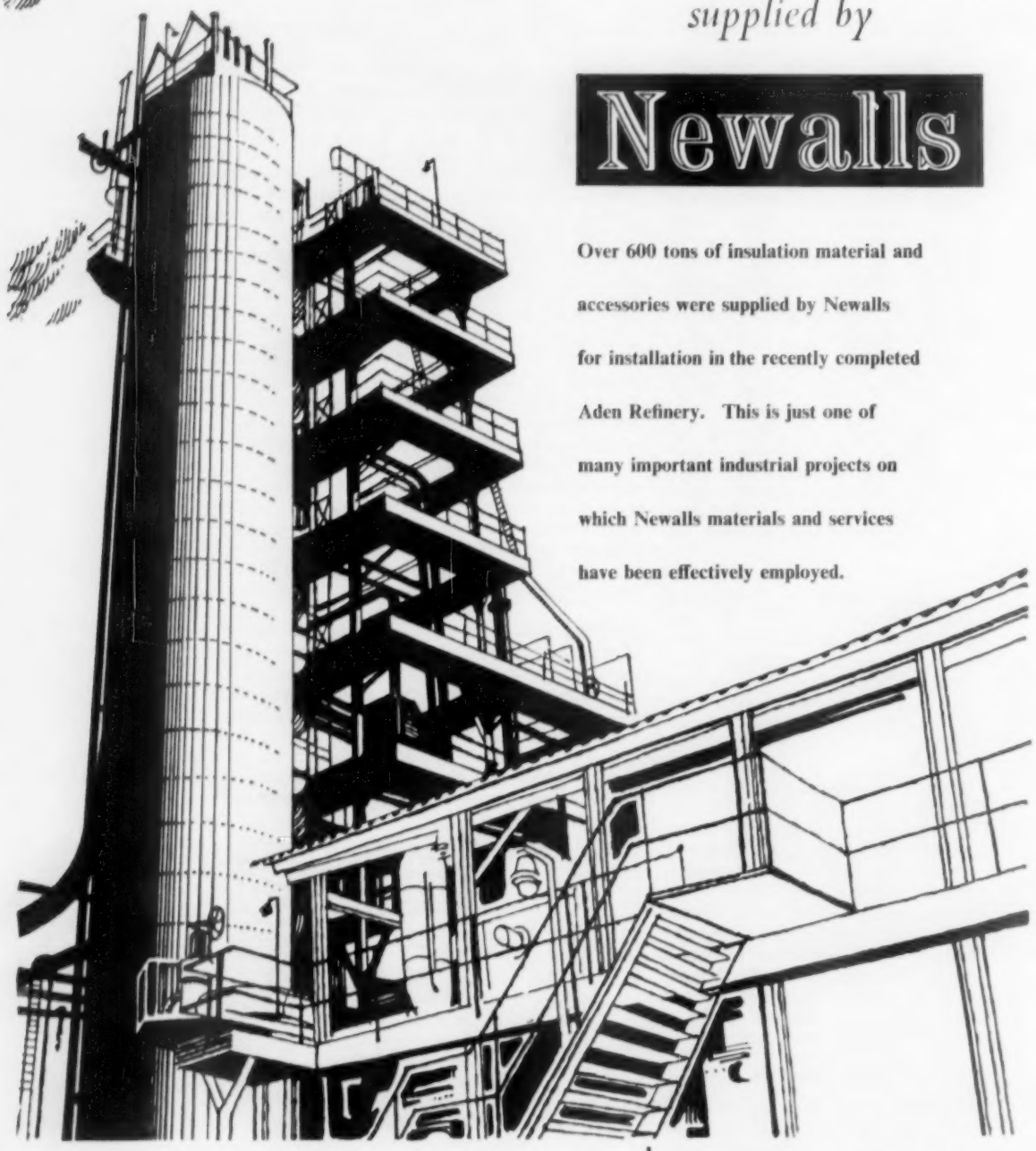


Fig. 5—These typical piston failures were caused by: (a) abrasive wear; (b) operation in a scored liner; (c) poor lubrication; and (d) extrusion and pinching.

This material taken from Tool Pusher's Manual, A.A.O.D.C. Originally prepared by J. V. Mahan, National Supply Co., Pittsburgh.

Insulation material used in the Aden Refinery was supplied by

Newalls



Over 600 tons of insulation material and accessories were supplied by Newalls for installation in the recently completed Aden Refinery. This is just one of many important industrial projects on which Newalls materials and services have been effectively employed.

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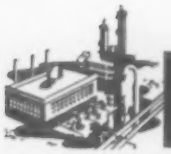

THE FOREMAN'S PAGE

Refining · Petrochem · Natural Gasoline

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—9

How Designing Can Avoid Heat-Exchanger Problems

SOME heat-exchanger buyers specify the minimum surface acceptable for each exchanger. To compute the surface, they use transfer rates from methods in the literature. Or they use service-transfer rates from existing exchangers. On the face of it, this may sound like good practice. But specifying surface reduces the manufacturer's role to that of filling an order. The buyer fails to benefit from the fruits of the manufacturer's research program and his wide experience with many users.

Q. How can you minimize ineffective surfaces in heat exchangers?

A. Cross baffles divide the shell side of an exchanger into small flow compartments. Usually the distance from the tube sheets to the nearest cross baffle is greater than the distance between any two adjacent cross baffles. The extra space is necessary because the shell nozzles cannot be installed close to the tube sheets. The nozzle weld must clear the shell weld at the end flange (see Fig. 3). The velocity of the shell-side fluid in the end cross-flow passes is therefore lower than in the other passes.

Since the transfer rate decreases with velocity, the surface in the end passes is only partially effective. The partially effective surface can be from 10 to 20 per cent of the total surface in an exchanger 16 ft. long. This ineffective surface can be kept to a minimum by mounting the nozzles on annular distributors.

This material is taken from training program notes, Esso Standard Oil Co., Baton Rouge, La.; and from notes supplied by refining department, Phillips Petroleum Co., Bartlesville, Okla.

Q. How can you prevent shell nozzles from causing partial bypassing in the end cross-flow passes?

A. The design of many exchangers directs the fluid flow from side to side in the shell of the exchanger. Theoretically then, the inlet nozzle should be on the side of the exchanger so that the fluid flows fully across the tube bundle in the first cross-flow pass. The outlet nozzle should also be on the side to use most effectively the surface in the last cross-flow pass. In actual practice, piping requirements call for nozzles on the top and bottom of the exchanger much more often than on the sides. Top and bottom nozzles cause partial bypassing in the end cross flow passes (see Fig. 4). Again, this problem can be licked by using annular distributors.

Q. How can annular distributors solve both these partial bypassing and surface ineffectiveness problems?

A. The distributor is formed from a cylinder larger in diameter than the exchanger shell. The sleeve inside the distributor cylinder has the same diameter as the straight portion of the shell (see Fig. 3). The space between the distributor cylinder and the sleeve is an annular passage for fluid. The shell nozzles weld to the distributors. An opening in the sleeve allows the fluid to enter the tube bundle at the side opposite the first cross-baffle cut. This arrangement eliminates any fluid bypassing of the end cross-flow passes, regardless of where the nozzles are located on the distributor. So the use of the annular distributor permits complete freedom of choice for shell-nozzle orientation around the entire periphery of the distributor.

The annular distributor minimizes surface ineffectiveness too. The sleeve cut takes up about 160° of the circumference of the shell. This long length allows a relatively narrow cut for a large flow area. The cut is close to the exchanger end flange. The end cross baffles go near the sleeve cut. Thus the distance from the end cross baffles to the tube sheets is much less with the distributor than with the nozzle welded directly to the shell. The amount of ineffective surface is kept small as illustrated in Fig. 3. The annular distributor also serves one more function. The sleeve acts as an impingement baffle.

Q. How can you protect the tubes from erosion?

A. The inlet shell nozzle needs an impingement device to protect the tubes from erosion. This protection is especially important for vapor streams that have some entrained liquid or for liquid or vapor streams containing solids. Various devices are used to protect the tubes. For example, solid impingement plates, two or more rows of closely spaced tie rods, swaged nozzles with bulls-eye plates, and the sleeve in an annular distributor (see Fig. 1).

The tie-rod type and the solid-plate type have several disadvantages. Tubes must be omitted from the bundle to provide entrance and exit area. The number of tubes omitted varies with the nozzle size. Thus the size of the shellside nozzles can affect tube-bundle interchangeability. The annular distributor and the swaged nozzle overcome these objections.

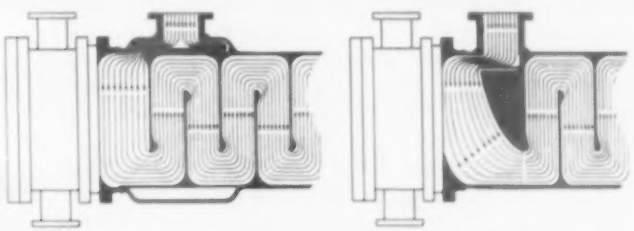

Fig. 3—Ineffective surface on an end cross-baffle location.

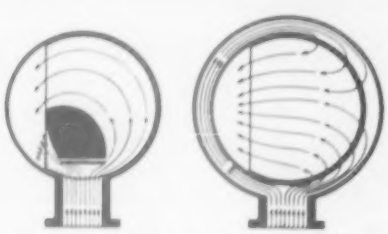

Fig. 4—Ineffective surface, shell-nozzle location.

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BETHLEHEM STEEL

by R. I. Martin

ELECTRIC LOGGING—61

Interpreting Different Logs of the Same Formation

ALTHOUGH it is possible to find empirical relationships between residual oil saturation and production, or resistivity, a more general approach is to work in terms of water saturation. It will be recalled that resistivity increases with a decrease in water saturation, and also with a decrease in salinity.

As a result of flushing during coring and subsequent partial loss of fluids when the pressure is reduced to surface conditions, oil saturation, water saturation, and salinity become changed. The decrease in water saturation above the water table would be more apparent if the corresponding decrease in salinity were taken into account and a corrected water saturation used.

Above this, salinity increases again where permeability becomes less. This may be due to one of two causes or a combination of both. First, flushing will be less in less permeable parts of the formation. Second, the presence of clay is found to result in high laboratory determinations of salinity. Sometimes these may be higher than the salinity of water produced from the sand, which does not seem to be a very reasonable result. A higher water saturation found in the less permeable part of the sand is a normal effect.

Author is assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy, Rolla, Mo.

The upper low residual oil saturation indicates a gas-bearing sand. Although the water saturation is high, the salinity is low. This indicates that flushing has taken place to a large extent though permeability is low.

Logging different values . . . Fig. 1 shows how different values may be logged at different times. They are caused chiefly by an increase in invasion and to a lesser extent by an increase in mud resistivity. Run 3 was made on October 7, 1951, when mud resistivity was 0.8 ohm-meter and mud weight was 9 lb. per gal. Run 4 was made on December 26, 1951, when the mud resistivity was 1.0 ohm-meter, and the weight was unchanged. The formation is mostly granite wash, which usually displays a fairly large degree of invasion.

Curves in the center track are taken with a 16-in. normal device.

Invasion does not appear to have affected the S.P. curve so much as the increase in mud resistivity.

Fig. 2 shows a case where high resistivity does not necessarily mean good production. Electric logs and radioactivity logs are shown for 1 Mainka, Grady County, Oklahoma. There is a depth discrepancy between the two logs of some 15 ft., and depths mentioned in this discussion refer to electric-log depths. The radioactivity log should be raised 15 ft. with respect to the depth scale when making comparisons.

Analyzing the differences . . . The second Bromide sand below 13,031 ft. presents a conventional appearance and proved to be productive. A test of the interval 12,900-36 ft. produced 1,600 bbl. of oil in 19 hours. Additional perforations were shot from 12,855 to 12,890 ft. and from 12,960 to 12,985 ft. The latter perforations were based on permeability and porosity observed in cores, and correspond to the two rounded bulges on the sloping part of the S.P. curve. Above 12,850 ft. the low S.P. curve indicates a lack of permeability.

Opposite the first Bromide sand, the neutron log shows low values due to fluid-filled porosity. These values are noticeably lower than those occurring opposite dense parts of the formation. It should be noted, however, that some intermediate neutron values are present which correspond to the core permeability between 12,960 and 12,985 ft.

The gamma-ray log shows that these lower values are not due to shale. These indications of possible production are not very strong, however. At the same time, the core indications were not particularly good either. No separate production test was made on the interval 12,960-85 ft. so that it is impossible to say whether an important volume of oil would have been passed up if the perforations had not been made.

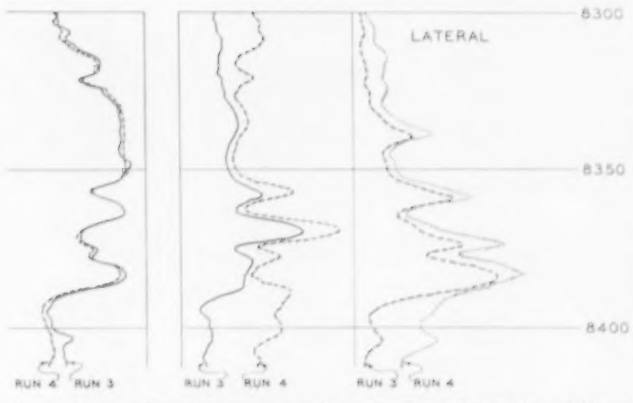

Fig. 1—Two different logs run on the same formation at two different times in Phillips' 1 Hobart in Gray County, Texas.

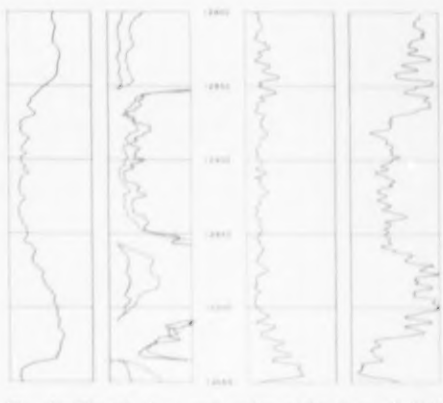

Fig. 2—Electric logs and radioactivity logs of Gulf et al.'s Mainka in Grady County, Oklahoma.

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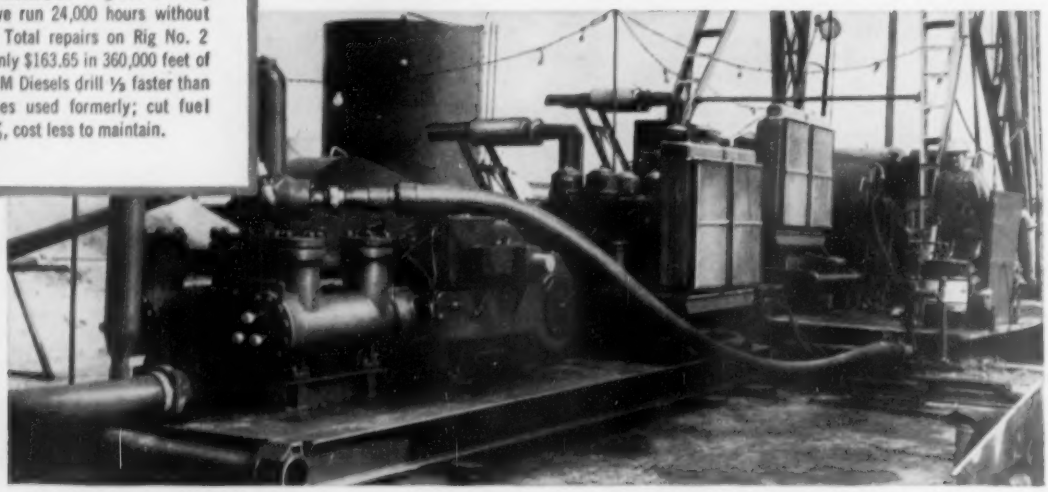

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CHEMICAL SURFACTANTS—1

Developing a Surface-Tension Equation

by C. E. Clason

THE contact phenomena and force relations between water and water solutions, oils, and solids is an old and well-known subject. For many years, attention has been increasingly directed to the action of certain of these forces upon the capillary flow of dissimilar and immiscible fluids. It was apparent that restricted flow conditions occurred and that release or reduction of some inherent or created forces could be beneficial, especially when this knowledge was applied to the production of oil from formations.

The increase in the number of surfactant products marketed for this purpose and their accompanying benefit claims has created some confusion. The following discussion presents some fundamental data for evaluating the desired results of any product application.

Surface phenomena . . . Fig. 1 illustrates a section of a globule of fluid resting at equilibrium on the plane

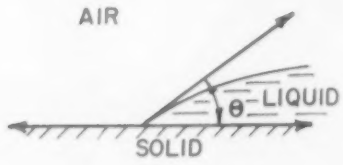

Fig. 1

surface of a solid. The tangent to the line of curvature of the globule forms an angle which is a measurement of the wetting and spreading ability of the fluid. It is also an indication of the film strength of the fluid. Thus as the angle grows greater denoting greater film strength, the fluid is less wettable.

Fluids considered nonwetting have an angle greater than 90°. Mercury on glass is an example. Water on glass or silica is less than 90°, but it can be treated by an agent to reduce film strength, lower the equilibrium angle, and be made wetter. Note that there are two mediums of contact for the fluid, air, and solid.

Now consider two fluids and air as shown in Fig. 2—such as a drop of oil on brine or water.

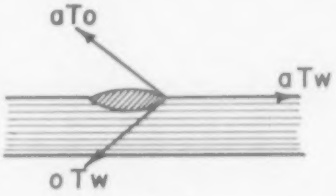

Fig. 2

There are three forces acting on the film strength of the drop of oil: the force between air and brine aw; between air and oil, ao; and between oil and brine, ow. All of these can be measured and values can be as follows, T representing tension or film-strength values—

aTw = 81 dynes per cm.
aTo = 36 dynes per cm.
oTw = 24 dynes per cm.

Now aTW > aTo + oTw
81 > 36 + 24

This shows that, according to actual determinations, the illustration is perhaps of momentary conditions, because the tension between the air and brine overbalances the other two forces combined. Oil will thus be dragged out or spread in all directions, forming a very thin film over the water.

Now we can treat the brine with an agent or surfactant which reduces its film strength so that aTw is only 32 dynes per cm. instead of 81 dynes. This also affects oTw, which is a desirable feature in an agent.

Then aTw = 32 dynes
aTo = 36 dynes
oTw = .5 dyne

Now aTW < aTo + oTw
32 < 36 + .5

This means that the brine now has a weaker film strength than before and our illustration has an application although with perhaps actually lower angles. It can be seen that with the same aTo, the result presents a weakening of brine film strength to air and oil. Brine can spread out under oil and wet a solid much easier.

Now we must combine all of the previously mentioned components—air, brine, oil, and solid—to see the effects upon pressure requirements and flowing conditions as applied to small capillaries such as exist in oil wells.

We know that the height (h) of a single wetting fluid in a solid capillary such as glass is proportional to aTw or surface tension of brine to air. And it is inversely proportional to R, the radius of the curved surface of the tube. So h is proportional to T/R, and as h is balanced by the force due to surface tension, it can be converted into pressure, (P). Then this means that $P = T/R$ for a single film. Then with two different curved surfaces, P is the sum of that due to each curvature separately or $P = T/R_1 + T/R_2$ which is usually stated as $P = T(1/R_1 + 1/R_2)$.

Now with two fluids such as oil and brine, the same principle applies—except we use as T the value of oTw, which is the interfacial tension (IT) between the oil and brine. But for accuracy, the component of this force is represented by the cosine of the angle of interface, θ.

The formula then becomes $P = \cos\theta \, IT \, (1/R_1 + 1/R_2)$ for an angle of 45° or more.

Author is with Halliburton Oil Well Cementing Co.

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New Drilling Companies

R. C. (Bob) Hess of Mt. Carmel, Illinois, and Jim Savares of Indiana, have formed a new drilling company to be known as the Hess-Savares Corp. The new drilling firm will be located at 416½ Market Street in Mt. Carmel.

Sam Giddens, Roy Pledger, and R. L. Mann have formed a new Illinois basin drilling company with offices at 710 Hulman Building in Evansville. This firm will be known as the Little 3 Drilling Co.

Loffland Bros. Drilling Co. has contract for The Chicago Corp.'s 12,000-ft. wildcat in Vermilion Parish, 2½ miles southwest of Abbeville field, Louisiana. The test, the 1 Espora Baudoin, is located in C NE¼ NE¼ 36-12s-2e.

Goldrus Drilling Co., Houston, has contract for Wherry & Green-H. L. Martin's 13,100-ft. wildcat in Live Oak field, Vermilion Parish, Louisiana. The 1 Carlton J. Foster et al., spots 675 ft. from the west line and 500 ft. from the north line of the lease in 87-14s-3e.

Contract has been let to **Falcon-Seaboard Drilling Co.** for a 11,200-ft. wildcat at 1 C. D. Thibodeaux for Amerada Petroleum Corp. about ¾ mile northeast of Leleux field in Vermilion Parish, Louisiana. This wildcat is spotted thus: from the NWc of SW¼ 18, go south 88° 2' east 1,757.1 ft., thence south 0° 14' west 330 ft. to location in 18-11s-2e.

Rowan Drilling Co. is contractor for Continental Oil Co.'s 10,000-ft. test at 1 State Lease 1944 in Chandeleur Sound Block 71 area of St. Bernard Parish, Coastal Louisiana. The well is 8,000 ft. west and 6,100 ft. north of the SEc of Block 71.

Nicklos Drilling Co. is contractor for Continental Oil Co.'s 1-B State Lease 984 in the West Delta Block 59 area of Plaquemines Parish, Coastal Louisiana. This wildcat is located 4,600 ft. from the south line and 4,750 ft. from the east line of Block 59.

Circle Drilling Co. is contractor for Temple Hargrove et al. 1 Trahan, a 10,000-ft. wildcat at Napoleonville in Assumption Parish, South Louisiana. This wildcat is in 34-12s-13e.

Penrod Drilling Co. received contract for Hassie Hunt Trust's Terrebonne Parish wildcat 4½ miles north of Pointe Au Fer field, South Louisiana. The 1 Mary A. Smythe Nelson will go to 14,000 ft. It is located in 21-20s-12e.

Power Rig Drilling Co. has contract for a 10,500-ft. northeast outpost well to production at Bosco field in St. Landry Parish, South Louisiana. The well is the Charles A. Lawrence, Jr., 1 Wil-

The day crew on the Brantly Drilling Co., Midland, Rig 3. The rig is air drilling the Humble Oil & Refining Co. 2 Blinebry-Tubbs Gas Unit, 3 miles north of Eunice, Lea County, Southeast New Mexico. Left to right: Leon Beard, driller; Benny Whitley, motorman; J. C. Johnson, derrick man; Jack Sherill, helper; W. C. Womack, helper. Brantly is the only contractor drilling with air regularly on a footage contract basis.

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fred Savoie, 1,900 ft. from the north line and 1,700 ft. from the east line of Section 26-8s-3e, just across the line from Acadia Parish. The wildcat is between Bosco field and Cankton.

Nicklos Drilling Co. is contractor for Continental Oil Co.'s 14,000-ft. wildcat on the southern flank of Acadia Parish's Rayne field. The 1 John Bearb et al., ⅓ mile south of the 1 Petitjean discovery, is in 4-9s-2e, Acadia Parish, South Louisiana.

Coulston Drilling Co. announces the removal of its offices to 742 The Fair Petroleum Bldg., Tyler, Tex.

Great Western Drilling Co. has contract for a 3,000-ft. Entrada test in the Seiber area of Grand County, Utah, in the NE NE NE 15-20s-23e. It will be drilled for Three States Natural Gas Co., Coulston Drilling Co., and W. R. Gibson, Jr., as the 1 Cullen-Government. Location is 10 miles east of Cisco.

Sunnyland Contracting Co. has contract for a 5,300-ft. wildcat to test the Eutaw formation in the graben area separating East and West Eucutta fields, Wayne County, Mississippi. It is the Tom McGlothlin 1 Jack Langley, C SW NW 12-9n-9w. A dry hole is located on the east offset to the new Wayne test. Sunnyland also has contract for a 6,100-ft. wildcat in Jefferson County, Mississippi. It is the Central Oil Co.-R. M. Moon 1 Guidon, 24-9n-2w. **Clinch Drilling Co.** will drill another Jefferson County wildcat at Gauthier & Heard 1 Mrs. Evelyn Junkin, 12-9n-2w. This one will go to 6,000 ft.

Woolf & Magee hold contract on a Natchitoches Parish wildcat in Louisiana. The A. J. Hodges Industries, Inc., and Ira A. Wyant are below 4,220 ft. in sand and shale. Objective is 6,500 ft. for the 1 Olin Oil & Gas Corp. The wildcat is 3 miles south of Derry in west-central Louisiana.

Glenn Drilling Co. has contract for a wildcat on the west flank of Holly field in 15-13n-14w, North Louisiana. The well is Renoun Corp. 1 Griffith, which is drilling at 7,086 ft. after finding nothing in the Pettit or upper Travis Peak. The well will be taken on down to 9,000 ft. to test Cotton Valley sands.

Carter-Jones is contractor on wildcat for Sunray Mid-Continent Oil Co. et al 1 mile southwest of Bivins in Cass County, East Texas. The well will be known as the 1 Grogan Manufacturing Co. on the Wm. Donaho Survey A-249. The wildcat will go to 7,600 ft.

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Here's what an A.P.I. survey revealed about . . .

Coating practices and protection costs

by Dean C. Glass

- About 95 per cent of today's crude and products lines are being coated.
- Industry preference is for coal-tar coatings.
- Protection costs on bare lines are about 10 times as much as those on coated lines.

THE following survey of cost and coating practices was made by the author on behalf of the committee on pipeline technology of the American Petroleum Institute. It shows what the predominate trends are in the protection of underground pipelines and the costs of such preventive measures.

For an economic analysis, there is no known method of estimating uncontrolled corrosion costs on pipelines. Therefore it is difficult to estimate the savings which have been achieved by preventive measures. However, representative costs of protection are given in Tables 1, 2, 3, and 4. These tables are from a cross-section survey of the crude and products pipeline industry. They give average costs of coatings and cathodic protection for the years 1930 through 1954. They cover line sizes 4 through 26 in. inclusive.

Sources . . . Thirty-two companies were solicited for data on construction and operating practices related to corrosion preventive measures. Replies were received from 28 companies representing a large percentage of the entire products and crude-oil pipeline industry. Data submitted by these companies was analyzed carefully and Tables 1 through 4 were compiled.

Table 1 shows that through the period 1930 to 1940, it was considered unimportant to coat small-diameter pipe (4 through 8 in.). Fully 60 per cent of such lines laid were bare. In contrast, Table 1 indicates that for pipe sizes 10 through 16 in., it was deemed advisable to protect the greater investment in steel by use of coatings. More than 94 per cent of larger-diameter lines were coated.

Table 1 also indicates percentage of trend toward type of coatings used and average cost per lineal foot of pipe coated.

From Table 2, it is evident that more consideration was given to coating pipe sizes 4 through 8 in. during the years 1940 to 1950 than in the preceding 10-year period. Only 22 per cent of the smaller sizes were laid bare. This 22 per cent also applies to pipe sizes 10 through 22 in. during the period 1940 to 1950. This increase in percentage of large-diameter pipe laid bare can be attributed to construction practices dictated by wartime conditions.

Table 3, for the pipeline construction period from 1950 to 1955, shows only 4.4 per cent of pipe sizes 4 through 8 in. was laid bare. Through the same period, 4.7 per cent of pipe size 10 through 26 in. was without coating.

Tables 1, 2, and 3 show average cost per lineal foot of coatings for 4 through

TABLE 1—PIPELINE COATING PRACTICE AND COST FOR PIPE LAID FROM 1930 TO 1940

Pipe size (in.)	Miles laid	Per cent Bare	Coal tar	Asphalt	Asphalt mastic	Wax or grease	Other	Per cent of pipe laid in each geographical location*	Average cost of coating per linear foot† (cents)
4	254	55	0	45	0	0	0	95 SW	
6	2,352	82	2	11	0	0	5	60 SW-35 MW	19.5
8	3,420	45	7	17	1	2	28	45 SW-50 MW	17.0
10	740	7	10	76	0	7	0	90 MW	29.0
12	707	5	0	82	13	0	0	85 MW-15 WC	34.0
14	15	0	0	100	0	0	0	100 MW	
16	5	20	0	0	80	0	0	100 WC	42.0

TABLE 2—PIPE LAID FROM 1940 TO 1950

Pipe size (in.)	Miles laid	Per cent Bare	Coal tar	Asphalt	Asphalt mastic	Wax or grease	Other	Per cent of pipe laid in each geographical location*	Average cost of coating per linear foot† (cents)
4	402	61	2	21	0	16	0	63 SE-19 SW	15
6	1,976	15	37	19	20	6	3	55 MW-22 E	23
8	5,652	22	41	19	16	2	0	38 NW-33 SW	29
10	2,538	53	19	21	4	3	0	44 SW-27 MW	30
12	2,622	16	25	50	7	1	1	45 SW-31 MW	37
14	21	0	12	88	0	0	0	100 MW	
16	1,028	0	2	98	0	0	0	80 SW-18 MW	44
18	215	0	0	18	62	0	20	82 WC-18 MW	54
20	1,304	0	59	41	0	0	0	86 MW-14 SW	62
22	158	0	0	48	52	0	0	100 MW	75

TABLE 3—PIPE LAID FROM 1950 TO 1955

Pipe size (in.)	Miles laid	Per cent Bare	Coal tar	Asphalt	Asphalt mastic	Wax or grease	Other	Per cent of pipe laid in each geographical location*	Average cost of coating per linear foot† (cents)
4	326	15	84	0	0	1	0	72 SW-27 NW	21
6	706	5	77	15	3	0	0	67 SW-21 NW	38
8	2,787	3	71	20	6	0	0	46 MW-27 NW	33
10	2,225	15	68	9	8	0	0	45 SW-43 MW	37
12	3,365	0	85	8	6	1	0	75 MW-24 SW	50
14	690	13	87	0	0	0	0	66 SE-27 E	
16	507	0	74	26	0	0	0	62 SW-19 NW	48
18	454	0	100	0	0	0	0	95 SE	56
20	603	0	58	42	0	0	0	72 SW-21 NW	54
22	379	0	36	64	0	0	0	65 SW-35 NW	56
24	321	0	12	78	0	0	0	99 SW	58
26	493	0	100	0	0	0	0	100 SW	50

*Geographical locations abbreviated: SW, for Southwest; MW, Midwest; WC, West Coast, etc. Only areas containing largest percentage of pipe are listed. †Includes material and application.

Of coated pipe listed, the following percentages were coated over ditch during construction: 1930-40, 99.7 per cent; 1940-50, 89 per cent; 1950-55, 92 per cent.

Author is with Pure Transportation Co. Portion of a paper presented to the annual spring products-pipeline meeting of the American Petroleum Institute's division of transportation, held in Chicago, May 16-18, 1955.

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26-in. pipe sizes from 1930 to 1955. It is difficult to compare coating costs indicated in the three tables since consideration must be given to various coating materials and methods of application.

Table 4 has been prepared to show cost data for cathodic protection by rectifier, galvanic anodes, or both, for coated and bare pipe. Since data submitted did not in all cases include line size, type of coating, and geographical location, a detailed analysis of cathodic-protection costs was not possible.

Rectifier costs shown are for power only and do not include depreciation and maintenance of the system. Cost indicated for magnesium anodes includes first cost of magnesium and installation costs and depreciation, assuming 10-year life.

Table 4 also indicates miles of pipeline reported, per cent of system under cathodic protection, and leaks per year. A leak frequency per 100 miles per year has been calculated for comparison with other systems reporting their various protective measures and leaks.

This table also shows average cost per leak as reported. In comparing leak costs, operators of products lines should note that leaks in products systems cost about five times that of crude-oil leaks. However, a single leak could cost thousands of dollars in property loss and damage claims and in no manner could be compared with the average cost shown.

In this paper it was not deemed advisable to attempt an evaluation of various types of coatings as to performance. Nor were comparisons made on the economics of lower-first-cost coatings and resulting higher maintenance cost with high initial construction costs and low maintenance.

Yard application of coating . . . As an indication of customer demands for mill or yard coating for ¾ through 26-in. pipe sizes, leading yard applicators were solicited. Their reports indicate that for all pipe coated:

1. Ninety per cent of customers specify coal tar.
2. Forty per cent of customers specify one wrap of 15-lb. asbestos felt.
3. Twenty-nine per cent of customers specify one wrap of glass-type wrapper.
4. Thirty-one per cent of customers specify one inner wrap of glass type and one external wrap of 15-lb. asbestos felt.

The above data is for the period 1951 through 1953. The survey did not include asphalt-mastic yards.

TABLE 4—LEAK EXPERIENCE AND POWER COST FOR CATHODIC PROTECTION

Length of pipeline system, miles	Per cent of system having cathodic protection	Leaks per year	Leaks/ 100 miles/ year	Cost/leak (dollars)	Rectifier power† cost, $/mile/year		Magnesium anode cost, $/mile/year	
					Coated pipe	Bare pipe	Coated pipe	Bare pipe
2,253	17	1,207	54.9	432	8.44	8.44	10.00	10.00
1,172	91	0	0		2.70		.80	
445	100	0	0		1.20			
546	100	0	0		6.62			
1,348	38	200	14.9	175	10.60		16.30	
9,120	30	1,602	17.6	750	18.00			
2,061	82	5	0.2	*2,500	18.38	22.75		
1,195		75	6.3		1.00	4.70		
763	100	1	0.1		1.22		5.67	275.04
‡1,578	50					125.00		250.00
‡2,628	100				3.00			
‡2,400		25	1.0	*1,600				
1,152					5.30		5.17	
195	100	0	0		1.10			
625	18				11.18	87.38		
573	65	130	22.6	130				
98	100	0	0		3.15			
9,078	65	216	2.4	865				
9,244	31	539	5.4			46.00	25.00	
268	100	0	0		0.64		3.11	
485	100	7	1.4	*1,555		61.80		
1,043	99	1	0.1	250	29.50		20.00	
2,140	87	2	0.9	*1,600	1.20		1.34	
¶427	1	20	4.7	300				150.00
¶569	86	1	0.2	300			10.00	
¶75	20							
77	100	1	1.3	*1,350	6.24	90.00		
5,313	55	165	3.1	*1,686	11.43			161.00
414	100	2	0.5	400	4.39			
6,040	45	242	4.0		8.08	15.05	47.30	127.50
211	100	0	0		3.33	73.33		

*Indicates product pipelines. †Data submitted did not indicate line sizes (all data includes 4 through 26 in.). ‡Lines belonging to one company. ¶Lines belonging to one company.

Conclusions . . . From analysis of data in Tables 1, 2, 3, and 4 on 63,500 miles of pipelines, it can be concluded that:

1. From 1930 to 1940, 40 per cent of pipe was coated (4 through 8 in.) and 94 per cent of pipe was coated (10 through 16 in.).

2. From 1940 to 1950, 78 per cent of pipe was coated (4 through 22 in.).

3. From 1950 to 1955, 95 per cent of pipe was coated (4 through 26 in.).

4. An average cost of a specific coating cannot be determined due to the number of variable factors.

5. Rectifier power cost per mile per year for cathodic protection of coated lines averages $7.12. The median power cost per mile per year is $4.85.

6. Rectifier cathodic-protection power cost per mile per year for bare pipe shows an average of $53.41 and median of $53.90.

7. Half of the reporting companies have over 90 per cent of their facilities under cathodic protection.

8. Preference for most companies is for over-the-ditch coating. From 1930 to 1954, 91.7 per cent of the coating jobs for the companies surveyed were done over the ditch.

9. Leak costs on products lines average about five times as much as those on crude lines.

10. From 1930 until today, the trend in coating material is definitely toward coal tars.

Acknowledgment

The following companies contributed much information necessary for preparation of this paper: Arkansas Pipeline Corp.; The Buckeye Pipe Line Co.; Cities Service Oil Co.; Detroit Southern Pipe Line Co.; Great Lakes Pipe Line Co.; Gulf Refining Co.; Humble Pipe Line Co.; Imperial Oil, Ltd.; Interstate Oil Pipe Line Co.; Magnolia Pipe Line Co.; The Ohio Oil Co.; Pan American Pipe Line Co.; Phillips Pipe Line Co.; Plantation Pipe Line Co.; Pure Transportation Co.; Salt Lake Pipe Line Co.; Service Pipe Line Co.; Sinclair Pipe Line Co.; Socony Mobil Oil Co., Inc.; Sohio Pipe Line Co.; Southeastern Pipe Line Co.; Standard Oil Co. (Calif.); Standard Oil Co. (Ind.); Sun Pipe Line Co.; Sunray Pipe Line Co.; The Texas Pipe Line Co.; Trans-Northern Pipe Line Co.; Wyco Pipe Line Co.; Hill, Hubbell & Co.; Pipe Line Service Corp.; and Standard Pipe Protection, Inc.

Special thanks are due O. L. Entrekin and J. A. Wisdom of Pure Transportation Co. for suggestions and aid in preparation of the cost data.

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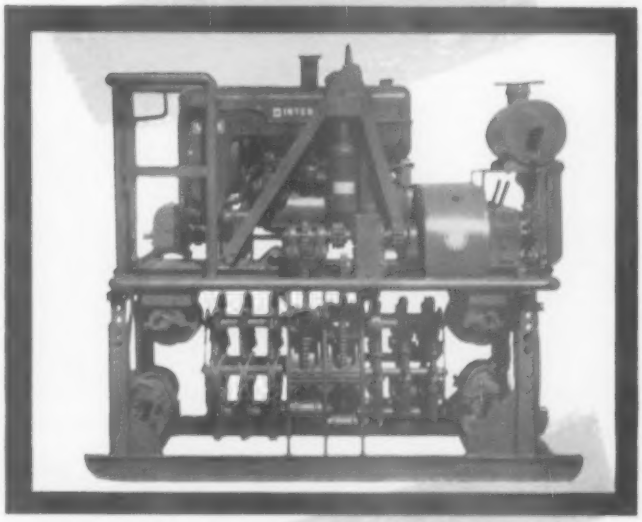
CROSE LINE TRAVELING PIPE CLEANING AND PRIMING MACHINE



This versatile pipe cleaning and priming machine can be used for line traveling operation or with stationary base (shown above) for yard cleaning and priming—either way it is better built and more efficient to give you faster, trouble-free service. Crose cleaning and priming machines are available for all sizes of pipe including 36".

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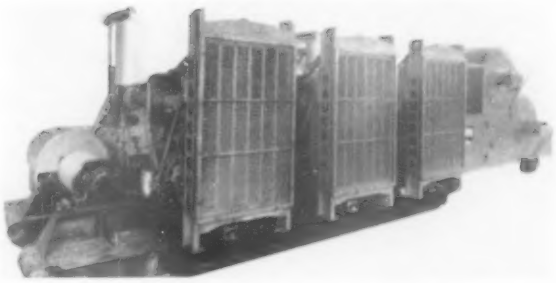
. . . What's New in Equipment?

Use the handy Time-Saver Cards ✔✔✔ to obtain additional information on these items

by Dan B. Miller



Compound Features High Service Factor

The new Model 3-250-P compound has been designed with the highest service factors possible in all its components. Ease of servicing has also been designed into it so that down-time will be held to a minimum.

Three 250-hp. engines, with pump drive, are mounted on a rugged skid framing with absolute parallelism between shafts. Air-compressor mounting with an inboard drive to the air compressor permits an over-all width from front of radiator to outermost end of rotorseal guards of 127 in. All oversize-shaft assemblies may be removed from this compound in the field without having to move either the case or the engines from their positions.

The hand compressor mounted on the compound provides sufficient air for engaging the clutch of the No. 3 engine, thus eliminating the need for an expensive extra compressor for starting purposes. Water-tight aluminum inspection hatches permit instant inspection of chains and oversize bearings inside the case at any time, without the use of tools. *Texas Iron Works.*

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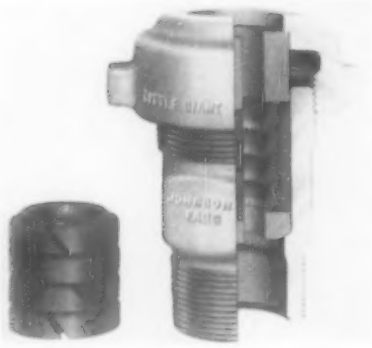


Little Giant Stuffing Boxes Minimize Leakage

Two new Little Giant stuffing boxes are available for use on shallow to medium-depth wells. The J-F economy stuffing box is made of high-strength malleable iron. Recommended for working pressures up to 1,500 psi., it is available with 2, 2½, or 3-in.-bottom male threads.

For combined pumping-tee and stuffing-box applications, there is the new economy-tee-type stuffing box now available only with 2-in. upset or regular-bottom female threads. Top and bottom threads of all J-F Little Giant stuffing boxes are guaranteed concentric with the inside bore of the box.

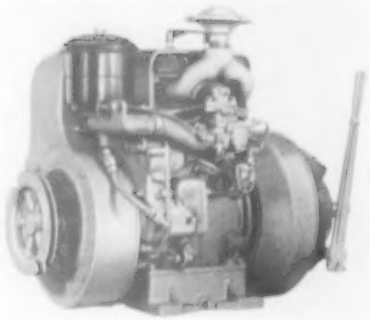
Economy stuffing boxes are priced complete with four 2¼-in.-o.d., J-F cone-seal-packing rings and nonscoring guide bearings. Leakage is minimized. Because of cone-seal-packing design, the lip of each ring effects a firm but resilient seal. *Johnson-Fagg Engineering Co.*

Check No. 2 On The Time-Saver Card

Wisconsin Designs Engine Specifically for Pumps

The new Model TFPD Wisconsin, a 3¼ by 3¼-in. engine with 53.9-cu. in.-piston displacement delivers from 8.7 to 13.2 hp. at engine speeds ranging from 1,400 to 2,200 r.p.m.

This engine has been designed to meet the variable-load fluctuations encountered in oil-well pumping where the load often varies from zero to maximum 10 to 25 times a minute. It is also suitable for any type of power application where there is a rapidly changing variable load.



This new engine has two flywheels. The standard cooling flywheel is at the cranking end, and an extra-heavy 80-lb. flywheel is located at the power-takeoff end of the engine. This design almost triples the momentum factor, thereby handling the pumping load with the greatest efficiency and economy.

In addition, this engine is equipped with an oversize heavy-duty dry-type clutch (furnished as standard equipment) to assure long clutch life under the terrific shock and fluctuating-load conditions imposed by oil-well pumping.

Heavy-duty features include: tapered roller bearings at both ends of the crankshaft; Stellite exhaust valves and valve-seat inserts; positive-type valve rotators; replaceable-valve guides; low-oil-cutoff switch and high-temperature automatic safety switch. *Wisconsin Motor Corp.*

Check No. 3 On The Time-Saver Card

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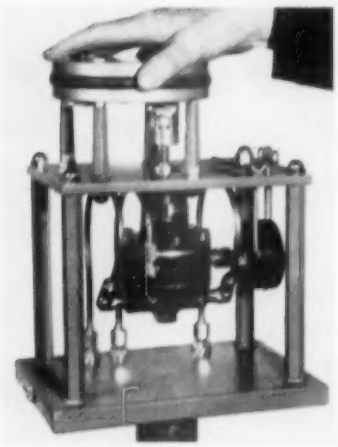


Continuous Gas Sampler Determines Gas Properties

Accurate determination of chemical and physical properties of gas samples is obtainable with a new continuous gas sampler.

This instrument, the Arcco 100, will, over a period of 7 days, accumulate at a constant rate a sample of gas to a final pressure at or near 100 psig. from a sample source whose minimum pressure is not less than 125 psig. When required, the instrument can be furnished for a lower pressure sample.

The design is based on the principle that the maintenance of a constant rate of increase in gas pressure within a closed container—from zero to any selected maximum pressure—will result in a constant rate of flow of gas into the closed container. This constant rate of increase in gas pressure into a gas-sample container is accomplished by means of a regulation system equipped with a precision-drive mechanism. This permits obtaining a constant and predetermined rate of increase in the outlet-gas pressure into the sample container.

A 7-day recording chart is used to show the constant rate of increase in gas pressure from gas sampler into the gas-sample container over a complete 7-day period. *American Recording Chart Co.*

Check No. 4 On The Time-Saver Card

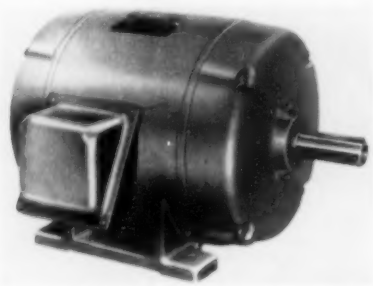
●

Oil-Well Pumping Motors Rerated for NEMA Standards

A new line of oil-well pumping motors in rerated N.E.M.A. frame sizes 182 through 326 is designed especially for oil-field service.

The motors have rugged, corrosion-resistant, cast-iron frames that are smoothly contoured so moisture cannot collect on surfaces. Construction is so completely dripproof that the motors are virtually splashproof. Yet they operate at 40° C. continuous-duty rated-temperature rise and have a service factor in accordance with N.E.M.A. standards.

For protection from rain, snow, and sand, the motor ventilating-air intakes are located at the bottom of the end plates. Air outlets are positioned at the



base of the frames on each side. All ventilating openings are screened to keep out rodents and reptiles. Extra protection for stator windings is provided by baffle plates which also serve to direct air into the blowers and through the motor.

This new design is being used in polyphase oil-well pumping motors in 1 to 30 hp. ratings and for 1 to 10 hp. single-phase motors. All motors are equipped with ball bearings which are provided with means for relubrication when necessary. *Wagner Electric Corp.*

Check No. 5 On The Time-Saver Card

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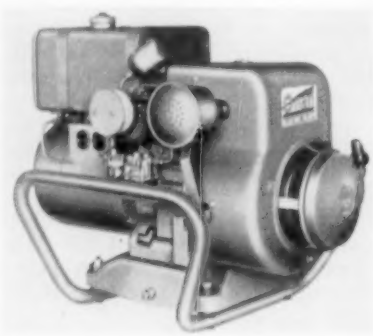

Generators Provide More Output at Less Weight

A complete new line of small engine-driven electric generating plants ranges in size from 500 to 2,500 watts. These new air-cooled, gasoline-operated electric plants will provide greater output at less weight and for lower cost. The heavy-duty, 4-cycle engines—designed specifically for generating-plant service—will outlast and outperform general purpose engines used for the same application.

The new models are available in sizes of 500 and 750 watts, 60-cycle, a.c. for the AK series, and in 1,000 and 2,500 watts, 60-cycle, a.c. in the AJ series. Battery-charging units are available in sizes ranging from 500 to 1,500 watts d.c.

Because of their small size and high output per pound of weight, the new AK and AJ models are highly suitable for mobile and portable applications. Their efficient air-cooling and sturdy cast-iron construction makes them ideal for heavy-duty service where installation space is at a premium.

For oil fields and other projects where electric power must be supplied independently, these new models easily meet the most critical requirements of portability and heavy-duty service.

The AK models are powered by an Onan air-cooled, 4-cycle, single-cylinder gasoline engine that delivers 1.85 hp. at 1,800 r.p.m. On the AJ models, the engine delivers 2.75 hp. at 1,800 r.p.m. and 5 hp. at 3,600 r.p.m.

Both AK and AJ engines are equipped with: (1) rotating Stellite-faced exhaust valves; (2) solid Stellite exhaust seat inserts; (3) extra-large, long-life bearings; (4) a radio shielded, high-tenson magneto ignition; (5) a built-in governor; and (6) a permanent mesh air-cleaner with oil-dipped pack. *D. W. Onan & Sons, Inc.*

Check No. 6 On The Time-Saver Card

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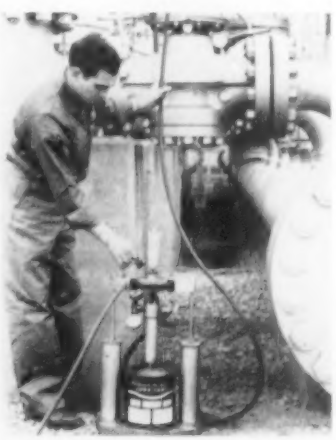

New Valve Lubricant Covers Wide Temperature Range

This new multipurpose valve lubricant has a wide field of applications and temperature range. The product, No. 555 lubricant, offers good metal-

wetting qualities at both subzero and highly elevated temperatures. It is unusually resistant to mixtures of hydrocarbons in both acid and alkaline solutions.

Said to be suitable for a wider range of services than any plug-valve lubricant now on the market, 555 completely replaces four other lubricants in the line. It has an efficient temperature range of 40° below zero to 500° above in bulk form, and 20° below to 500° above in stick form.

It is especially recommended for hydrocarbon liquid and gas services, including gasoline, kerosine, fuel and lubricating oils, crude distillate, sweet or sour natural gas, manufactured gas with water or organic condensate, L.P.G. systems, dilute acids and alkalis, glycols, aqueous solutions, and water.

Typical applications of valves in which this lubricant is recommended include agitator drawoffs, gas drips, sour gas containing hydrogen sulfide, loading racks, transmission lines, and gas-compressor stations. *Rockwell Manufacturing Co.*

Check No. 7 On The Time-Saver Card

Manual-Reset Valve Is for Emergency Safety Services

Type 73-20 manual-reset valve for emergency safety services features quick, positive action. Combining simplicity of design with positive action, the valve has many applications. It may serve as a safety shutoff in either liquid or gas-fuel lines, as a safe open valve for steam or foam fire-snuffing systems, or to shut down pipelines that indicate a line break by loss of pressure.

The Type 73-20 utilizes bodies, trim, and topworks of BS&B diaphragm-control valves with a delatching-trip mechanism to provide any usually specified

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safety requirement. Such response remains effective until manually reset. *Black, Sivalls & Bryson, Inc.*

Check No. 8 On The Time-Saver Card

New Geiger Counters Are Completely Transistorized

A new line of Geiger counters features a completely transistorized power supply. The heart of the new instruments is a complete, packaged, plug-in, transistor power supply that will give one of the instruments a 1,000-hour life on two 1½-volt flashlight batteries. This means that on a 24-hour continuous-use basis, it will approximate shelf life in a flashlight battery.

In addition, the instruments will be more compact and weigh less than half as much as others of comparable style. These instruments are among the most

There's bound to be some *loss of services* in the transfer of key workers from one locality to another. But United's Pre-Planned Moving Service helps cut this loss to a minimum. Pre-Planning takes care of all the details ... allows the executive, salesman, skilled worker and other key people to shift from the old job into the new with the least confusion. Your nearest UNITED Agent will be glad to call and explain.

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sensitive ever constructed to read full scale on ordinary cosmic gamma rays.

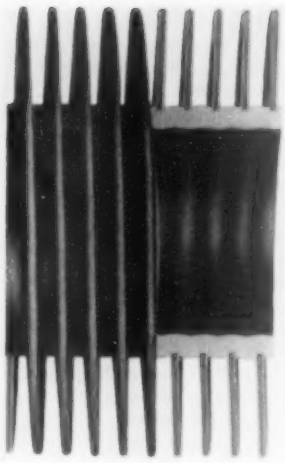
A gun-type Geiger counter weighs less than 4 lb. A walking-stick Geiger counter with audio weighs less than 3 lb. An audio can be used with any Geiger counter now in use.

In addition, the transistor power supply will soon be available for use in other portable instruments in every field of endeavor. *Universal Atomics Corp.*

Check No. 9 On The Time-Saver Card

Finned Tube Designed for High Temperature Gases

The extremely high-temperature gases produced by combustion, by many catalytic reactions, or in the regeneration of catalysts by oxidation of coke formation offer an opportunity of heat recovery to generate steam or to heat liquids. Finned surface is best adapted for transfer of heat from the hot gases to a liquid because such surfaces compensate for the difference in heat-transfer coefficients of the two fluids.



The dual-metal helical fin is sealed to the tube by a special brazing alloy. The fin has a copper interior for high heat conductivity, with austenitic stainless steel cladding for resistance to oxidation. It is embedded in the tube by a patented process, and is sealed by a nickel-chrome brazing alloy.

This finned-tube construction, known as the high-temperature K-Fin, can be used in convection heaters with inlet-gas temperatures as high as 2,600° F. heating liquids within the tubes to temperatures up to 1,500° F. The fin-tip temperature is maintained at temperatures closely approaching the temperature of the tube fluid, and well within permissible operating limits for stainless steel.

This new technique makes possible the recovery of heat from higher-temperature fluids with a more compact furnace at a lower cost. *The Griscom-Russell Co.*

Check No. 10 On The Time-Saver Card

Darcova Packing Now Made of Nylon Composition

Darcova packing products are now made of 100 per cent nylon composition.

The new nylon Darcovas are offered after many months of research, development, and field testing. They are considerably stronger than previous types, and in all applications show marked gains in service life.

The nylon Darcovas are available in the complete range of sizes and textures normally required to assure maximum pumping efficiency under varying conditions of depth, pressure, temperature, corrosion, and abrasion. *Darling Valve & Manufacturing Co.*

Check No. 11 On The Time-Saver Card

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LARGE...
OR SMALL . . .
TRAYS
Simple and adaptable in design, GLITSCH "Truss-Type" lightweight trays can be designed for any process requirement with respect to tray size, process layout, type of flow, type and shape of downcomer, weirs, wells, and size and shape bubble caps as well as suitable corrosion resistant materials.
GLITSCH BUBBLE CAPS
Dies for 287 different cap and riser assemblies are now available. The cap styles can be varied further by a wide range of slots. Holddown styles simplify clean-outs, reduce "off-stream" time to a minimum.
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For operation against discharge pressures of up to 30,000 P.S.I.G.

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Capacities from .6 pint to 17.5 gallons per hour.

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They're NEW

- Bulletins
- Catalogs
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for your copy, check ✓ ✓ the Time-Saver Cards.

Automation Through Varitrol Control is the subject of a new full-color eight-page booklet just off the press. Multi-color cross-sections and diaphanous views show how an improved pneumatic control called Varitrol has been designed into Varidrive motors to increase and/or improve output of a product, reduce waste, and save time and man power. An interesting dimensional schematic drawing shows the Varitrol as a pneumatic amplifier composed of a power and a signal system. The booklet illustrates how the high-pressure power system, controlled by a low-pressure signal system, operates a piston in a cylinder which acts upon the Varidrive speed-control lever. *U. S. Electrical Motors, Inc.*

Check No. 12 On The Time-Saver Card

●

Refractory Concrete. Of wide general interest, this eight-page booklet presents the characteristics and advantages of refractory concrete. Written in non-technical language, it covers expansion and contraction, thermal conductivity, reinforcement, mortar for jointing, high temperature, patching, heat insulation, and curing. *LaFarge Aluminous Cement Co., Ltd.*

Check No. 13 On The Time-Saver Card

●

CM Lodestar Electric Chain Hoist Bulletin. A 12-page illustrated catalog, No. 158, has been released on the new CM Lodestar, an electric chain hoist. The bulletin presents a complete description, including specifications and prices, of a hoist available in capacities from ½ to 1 ton for operation on 115 volts and 208-220/440 volt power. *Chisholm-Moore Hoist Division, Columbus McKinnon Chain Corp.*

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Hortonclad, a four-page leaflet, describes a composite metal having an integral and continuous bond produced by a new and revolutionary high-vacuum-brazing process. Hortonclad provides the most complete line of clad steels for use in fabrication of process

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Iron Sponge is your key to sulfur-free gas at minimum processing cost. Iron Sponge has high efficiency at low pressure or at today's high pressures and high temperatures. It absorbs *more* H_2S, gives long service between foulings, and is easily regenerated. Investigate it for your purification problem today!

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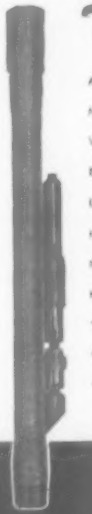

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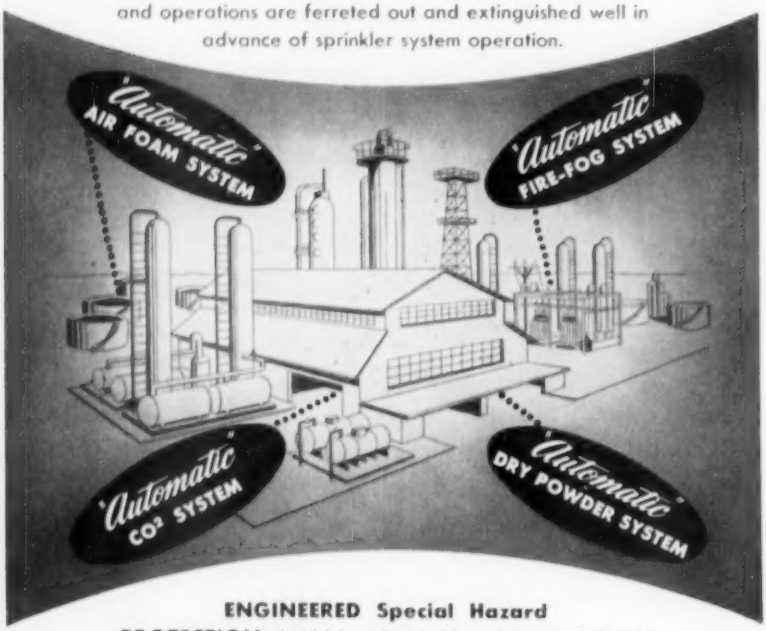
"Automatic" Sprinklers -PLUS-
ENGINEERED Special Hazard PROTECTION

While "Automatic" Sprinklers are generally conceded to be industry's most effective weapon against fire, production methods and occupancy hazards in most manufacturing plants are undergoing constant change. For example: An improved system for paint application or metal de-greasing can increase the hazard of fire a hundred fold. And, standard sprinkler protection may not be enough to detect fire fast . . . extinguish fire instantly.

That's where "Automatic" Sprinkler's ENGINEERED Special Hazard PROTECTION enters the picture. Employing such accepted methods of fire extinguishment as **FIRE-FOG, AIR FOAM, CO^2 and DRY POWER,** with fixed temperature, Rate-of-Rise, flame, smoke, flash or vapor detection—hidden and inherent fires of materials and operations are ferreted out and extinguished well in advance of sprinkler system operation.



ENGINEERED Special Hazard PROTECTION should be planned in advance of actual plant production, and the proper safeguard incorporated in the design or set-up of the equipment. In this way, out-of-service time and costly future alterations can be eliminated.

"Automatic" Sprinkler maintains a staff of Special Hazard ENGINEERS within easy reach of the 48 States and many foreign lands. Consult them in advance. They can help you to minimize fire loss and avoid costly shut-downs.

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Offices in Principal Cities of North and South America

and storage vessels. A wide variety of metals and alloys that have not previously been available are now possible with Hortonclad. *Chicago Bridge & Iron Co.*

Check No. 15 On The Time-Saver Card

●

Nine Profitable Minutes for Contractors. In a reading time of 9 minutes, this brochure outlines methods of increasing productivity through the use of Hyster job attachments on either new or used tractors. It is prepared from on-the-job case histories. Information is given on the economies of using tractor tools for profitable fill compacting, trenching, shoveling, pile driving, winching, yarding, salvage, and other construction tasks. Pictured are the Hystaway excavator crane, grid roller and donkeys, yarding, and winches. *Hyster Co.*

Check No. 16 On The Time-Saver Card

●

Power duplex pumps are described in five new eight-page bulletins. These bulletins, 436-7-8-9 and 440, show new increases in horsepower ratings of five Ideal pumps, types D-50, C-100, C-150-B, C-250, and C-350. These ratings now range from 80 to 600 hp. Bulletins give design features, performance charts, and specifications. *National Supply Co.*

Check No. 17 On The Time-Saver Card

●

Pritchard Hydryers. Bulletin No. 16.0.-081 details a line of packaged dehydration units for efficient drying of gases or air in industrial processing and laboratory installations. Four different types of Hydryers are covered. Load factors, dimensional data, and applications are carried in tabular form. Both full-stream and split-stream reactivation are shown in line drawings. *J. F. Pritchard & Co.*

Check No. 18 On The Time-Saver Card

●

The Scammell 6 By 6 Constructor, a four-page, two-color brochure, gives specifications on a ruggedly constructed truck made for heavy-duty and off-highway hauling and construction tasks. The brochure features the bogie articulation for cross-country work. *Scammell Lorries, Ltd.*

Check No. 19 On The Time-Saver Card

●

True Piping Economy. A yardstick for measuring basic-cost factors in the installation of piping systems is contained in a new eight-page illustrated booklet. The new publication compares wrought

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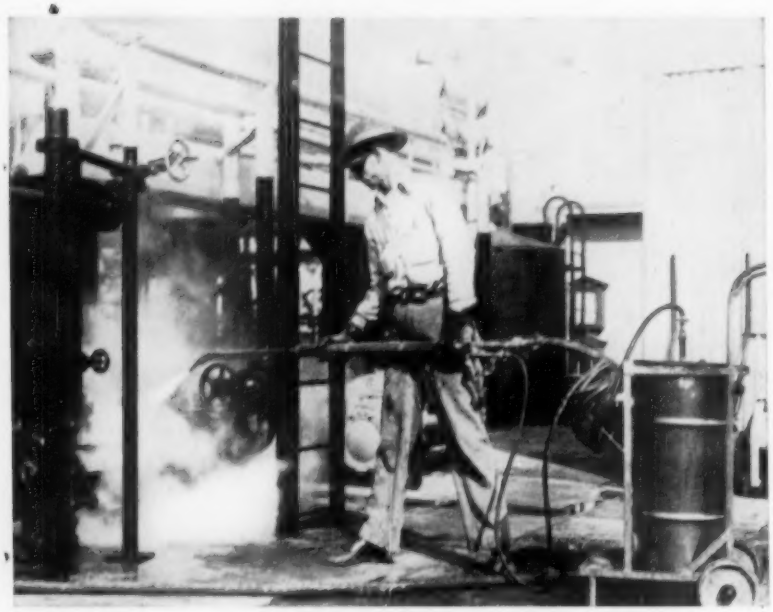


Cleaning Maintenance Cut from Days to Hours at Western Refinery

Refinery finds Oakite Detergent applied with Oakite Steam Gun makes short work of cleaning prior to repainting.

THE cleaning problem this California refinery had was simple enough. It was one of removing all dirt, grease and muck from tanks, pumps and similar equipment. But actually doing the job was not so simple. It meant tedious scraping, wirebrushing, wiping by a sizable crew. It involved struggling with hard-to-get-at surfaces. Did the Oakite Man have a better answer?

He did—as a result of his wide refinery cleaning experience. For this particular case, he suggested the Oakite 384 Steam Gun. He helped Maintenance get started that morning. By afternoon, the plant superintendent stated, "One man did about two weeks' work today".

Proving that—in industrial cleaning it always pays to consult Oakite.

YOUR OAKITE TECHNICAL SERVICE REPRESENTATIVE.—His experience is yours to draw on. He knows "cleaning engineering" and the conditions under which refinery cleaning can be best performed. His responsibility only *begins* when you order materials. He keeps in touch with you. He sees to it that the job is done right the first time, at lowest cost. Full of information is a FREE BOOKLET. Send for it today to Oakite Products, Inc., 44C Rector Street, New York 6, N. Y. Booklet contains helpful cleaning information in connection with:

Drum reconditioning • Descaling • Salvage cleaning

Tank interiors • Paint stripping

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U.S. & Canada

iron and other types of pipe in terms of three important costs to consider in buying pipe: initial purchase cost, cost of installation, and cost of maintenance. Contained in the contents of the booklet are several case histories of piping installations. A digest of the important uses for wrought-iron pipe in different types of industrial services is also included. *A. M. Byers Co.*

Check No. 20 On The Time-Saver Card

●

Deeper Penetration Perforating. This pocket-size booklet is essentially a series of photographs of test targets revealing effectiveness of super gun, shaped-charge gun, expendable shaped-charge gun, and expendable swing-gun methods. A bar chart shows depth of penetration and hole diameters for each of these methods. *Schlumberger Well Surveying Corp.*

Check No. 21 On The Time-Saver Card

●

Otis Cam-Type Tubing Perforator. A wire-line, mechanical tubing perforator is illustrated in this four-page, three-color folder. A series of cutaway drawings outline the operation of the tool and text material describes operating advantages and availability of the service. *Otis Pressure Control, Inc.*

Check No. 22 On The Time-Saver Card

●

Greenwood Valves. Including price lists, engineering data, and line drawings, this new catalog covers the gate-valve line blind, a self-closing sampling valve, a vertical-swing horizontal check valve, and a triple-action quick-closing valve. Application photographs are shown for each product. *Greenwood Valve Division, Vernon Tool Co., Ltd.*

Check No. 23 On The Time-Saver Card

●

The M DorrClone, a new six-page two-color bulletin, describes the physical characteristics, historical development, capacities, ranges of separation, and operating results of this new multiple-cyclone classifier. Included are photographs of standard units. *Dorr-Oliver, Inc.*

Check No. 24 On The Time-Saver Card

●

Swancoat Additive-Treated Paints. This 16-page brochure gives details of the development, uses, and advantages of additive-treated paints produced to meet the requirements of bulk-paint users. Special sections deal with structural steelwork, transportation industries, gas and water industries, plant maintenance, and technical-advisory service. *Thomas Swan & Co., Ltd.*

Check No. 25 On The Time-Saver Card

EQUIPMENT MEN . . . in the News

Youngstown to Build New Seamless Tube Mill

The Youngstown Sheet & Tube Co. will build a new seamless tube mill at the company's Indiana Harbor Works in the Chicago district. The announcement was made by J. L. Mauthe, company president. Work is scheduled to get under way promptly.

Pipe produced in the new mill, ranging from 4½ to 9⅝-in. o.d., is manufactured primarily for use in the oil fields.

The new seamless facilities will consist of two main buildings 2,000 ft. long to cover more than 400,000 sq. ft. They have been designed to permit future expansion. Each of the two buildings will house both hot-working and complete finishing and heat-treating facilities.

Baker Names Teitelbaum To Argentina Sales

Baker Oil Tools, Inc., announces the appointment of I. J. Teitelbaum as representative in Argentina. He has been active in operations of the Argentine oil fields since 1930.

Teitelbaum served Yacimientos Petroliferos Fiscales in various capacities in the production department and the drilling department. He toured the principal oil areas and manufacturing centers in this country in 1948, advising and participating in the purchase of machinery, tools, and equipment for drilling operations of the Y.P.F.

Waukesha Sales, Service Opens New Pampa Branch

Waukesha Sales & Service, Inc., has opened a new branch in Pampa, Tex., to provide better service for customers in the Texas Panhandle.

Leon Miller is manager of the Pampa store and district manager of the Texas Panhandle area for Waukesha Sales & Service. He has been resident representative for the company in and around Pampa for the last 4 years.

John D. Pharr is parts manager at Pampa. He was transferred to Pampa from the Shreveport branch. He has been with the company for 5 years, and has served in Louisiana, East Texas, and North Texas.

Crutcher-Rolfs-Cummings Demonstrates Coating Unit

A demonstration of Crutcher-Rolfs-Cummings, Inc.'s new coating machine was given recently in San Marcos, Tex., by Jim Cummings. Pictured at the test line are, top row: O. F. Bradford, A. J. Curtis Construction Co., Casper, Wyo.; R. L. Bethea, Brown & Root, Houston; Jim Cummings, C-R-C; "Pup" Vaughn, Zachary Construction Co., San Antonio; and Jack Henry, C-R-C. Bottom row are: Walter Garde, Brown & Root, Houston; Gene Morris, C-R-C; O. C. Mudd, Shell Pipeline Co., retired; and L. C. Cox, Gulf Interstate Gas Co., Houston.

Mission Will Soon Open Plant at Belfast, Ireland

R. H. ANSCHUTZ

Mission Manufacturing Co. will soon open a new manufacturing plant in the United Kingdom at Belfast, northern Ireland. This was announced by Richard E. White, Mission general manager. Robert H. Anschutz, at present assistant controller of Mission, has been named coordinator of the new plant to act as liaison man between the Houston and British plants.

Mission has long engaged in export business from the Houston plant. The new plant in northern Ireland, however, will enable Mission to serve oil operators better in areas where British sterling money, rather than American dollars, is the unit of exchange.

Ehrhart & Arthur Elects Sesler to Vice President

The board of directors of Ehrhart & Arthur, Inc., engineers and constructors, has recently elected Frank Sesler to the position of vice president. Sesler will continue as manager of the company's branch office at Oakland, Calif.

Brown & Root Makes M. P. Anderson Vice President

M. P. (Pat) Anderson, chief engineer from Brown & Root, Inc., since 1946, has been made a vice president of the firm, according to an announcement by George R. Brown, executive vice president.

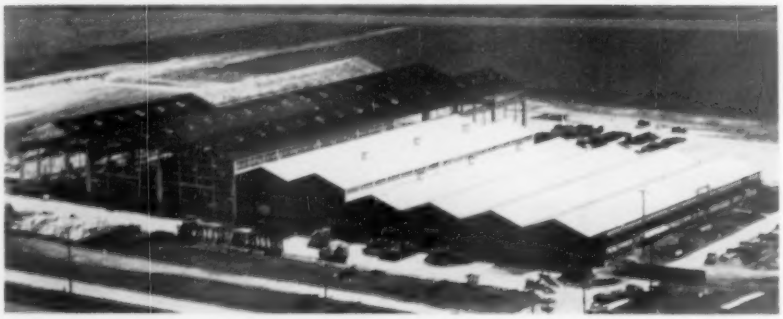
During the war years, Anderson was chief engineer in charge of design and construction for Brown Shipbuilding Corp. He first come with Brown &

Root in 1937 and was a chief engineer on the construction of Mansfield dam.

As chief engineer Anderson has had over-all responsibility for the company's entire design and construction-engineering activities. He headed a force of more than 300 permanent engineers.

Prior to coming with Brown & Root 18 years ago, Anderson was in charge of construction-plant design on the Grand Coulee dam, was an engineer on the Norris dam for TVA, a valuation engineer for the South Carolina Power Co., a construction engineer on hydroelectric plants in Georgia and Alabama, and did oil-field mapping work in Mexico.

Oilwell Starts Second Plant at Garland



This aerial view shows the progress of construction work on the second unit of Oil Well Supply's plant at Garland, Texas.

Construction on the second unit of Oilwell's fabricating, assembly, and warehouse facility at Garland, Tex., is moving at a rapid pace, says Fred F. Murray, president of the Oil Well Supply Division of U. S. Steel Corp. The new plant is scheduled for completion before the end of the year.

The expansion will add 90,000 sq. ft. to the existing 75,000-sq. ft. unit built in 1950. The plant is located on an 83-acre tract on the western edge of the city of Garland.

Simultaneously, B. J. Craig, Texas district erection superintendent for Consolidated Western Steel (also a division of U.S. Steel), announced that his crews have just completed erection of structural steel for the addition. The steel was fabricated at Consolidated Western's Orange, Tex., plant.

Zwart Will Head Marlow's Petroleum Pump Sales

H. C. ZWART

Marlow Pumps, division of Bell & Gossett Co., is placing its petroleum-pump sales under the supervision of Herman C. Zwart. A. F. Woods, Marlow sales manager, says "It is intended that he will, in addition to other activities, coordinate petroleum-pump sales so that this branch receives the specialized attention it deserves."

Zwart's first position was as a test engineer in the research and development department of the Worthington Corp. Before leaving, he was promoted to the New York district sales office. After this, he became a job engineer on power and utilities for Caltex, working on the Sidon refinery in Lebanon, Syria. Joining the U. S. Army Corp of Engineers, Zwart was employed in designing new equipment for military pipe lines. He was transferred then to the Far East and given the job of exec-

competition *makes it better!*

SURE, competition makes *everything* better. Competition made America great. Competition makes oil well cementing service better, too. On your next cementing job, call in the company that *put* competition in the business and *keeps it there.*

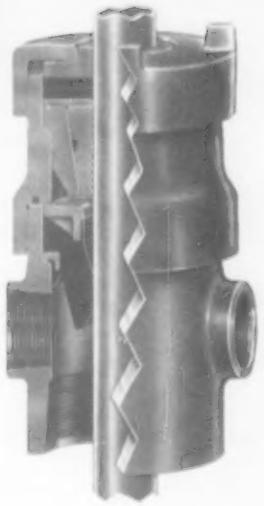
Engineered answers to oil well cementing

BJ SERVICE, INC.

For details see page 73.

LARKIN HEADS for medium pressure wells

LARKIN
TYPE "L"
TUBING HEAD



LARKIN
TYPE "SR"
TUBING HEAD

LARKIN
TYPE "R"
TUBING HEAD

The Larkin Type "L" Tubing Head . . . a comparatively new member of the Larkin Well Head Line . . . fills a need in low pressure areas where economy may be effected with complete safety.

Larkin Type "L" Tubing Head Features:

1. Forged steel construction
2. 2000 p.s.i. test
3. Full opening
4. 2" or 3" side outlets
5. Top of body threaded 7" API to accommodate control equipment
6. Hinged three-segment slips
7. Hammer-up lugs and bar holes for ease in make-up
8. Parts for 5½" and 7" sizes are interchangeable.

Also illustrated are the well-known, dependable Larkin Type "SR" and Type "R" 4000 p.s.i. test Tubing Heads which are so widely used in medium pressure fields.

For detailed information on these and other Larkin Tubing and Casing Heads, please refer to your Larkin Catalog or discuss them with your nearby Larkin Representative. All Larkin equipment is available through your supply store.

LARKIN PACKER COMPANY, INC.

ST. LOUIS, MO.

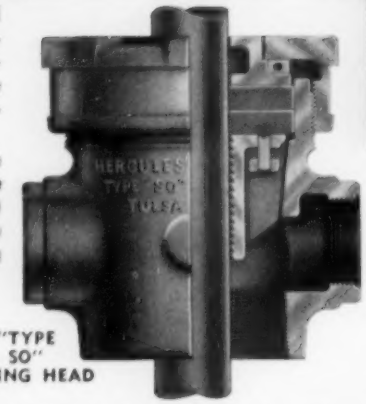
LARKIN
...Through Your Supply Store

HERCULES *Tubing Heads*

Reduce Production Costs

Hercules Tubing Heads were designed to meet all the requirements of present-day operations. Their simplicity, ruggedness and ease of operation make them the favorites of the most successful operators.

An All-Purpose Tubing Head in which a Neoprene Tubing Stripper can be installed (in body of this Tubing Head) instead of Slips and Packing, for use on semi-flowing wells, or on well servicing operations.

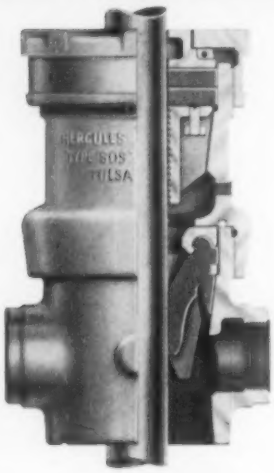


"TYPE SO" TUBING HEAD

DESIGNED AND RECOMMENDED By the men who use them.

SOLD AT ALL SUPPLY STORES

A versatile Tubing Head for formation fracturing, and for use on flowing wells. Male, female or Oil Saver Top Adapters available for all sizes.



"TYPE SOS" STRIPPER TUBING HEAD

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HERCULES TOOL COMPANY

Manufacturers of Oil Field Equipment

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Export Representative Oil Field Equipment Co., Inc. • 30 Church Street, New York, N. Y.

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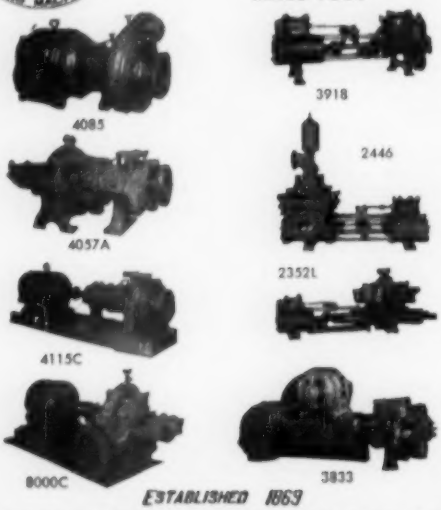
BUILDERS OF OUTSTANDING PUMPS
Since 1869



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INDIANAPOLIS IND.

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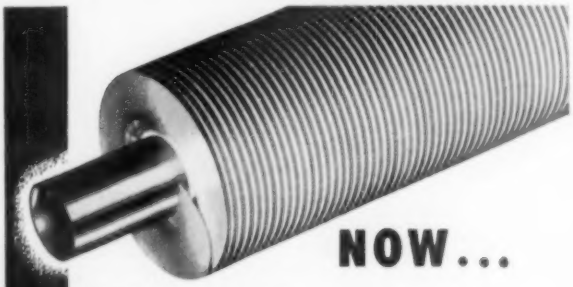

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Even Less Air Friction

with *AEROFIN Smooth-Fin* Heating and Cooling Coils

Write for Bulletin S-55

AEROFIN CORPORATION

SYRACUSE 1, N. Y.

utive officer for a pipeline company in Korea.

Rockwell Tests Valves For Below-Zero Field Operation

A special "torture chamber" to duplicate subzero field conditions was used at Rockwell Manufacturing Co.'s meter and valve-testing station to test a newly developed valve lubricant. The new product was designed for hydrocarbon-gas lines operating at temperatures ranging from —50° F. to 120° F.

Tests were performed in a walk-in deep-freeze icebox composed of two rooms, a test room and antechamber. Before entering the test room, engineers became acclimated to low temperatures in the refrigerated antechamber to prevent possible harm from a sudden and drastic temperature change. The entire system is cooled by a three-stage compressor and exhaust system which takes about 5 hours to reduce the temperature from 70° F. to —50° F.

The experimental lubricant formula was tested in a 24-in. Rockwell-Nordstrom valve. A standard-type valve stamp packing was used and the compound gear was greased with a special low-temperature gear grease. Line fluid used was nitrogen. It was supplied from a manifold hooked up so that the gas could be directed into the valve from either flanged end. Results of the test program indicated that the new lubricant gave a leaktight seal at temperatures ranging from —50° F. to +70° F., at 50 psi. and 800-psi. line pressure, both balanced and unbalanced on either flange. Substitution of a specially prepared low-temperature packing for conventional packing materially reduced the torque as much as one-third at —50° F.

Special subzero "torture chamber" which duplicates field conditions is used at Rockwell Manufacturing Co.'s test station to test a newly developed valve lubricant.

McCullough Opens Service Branch at Carmi, Ill.

R. B. BOWN

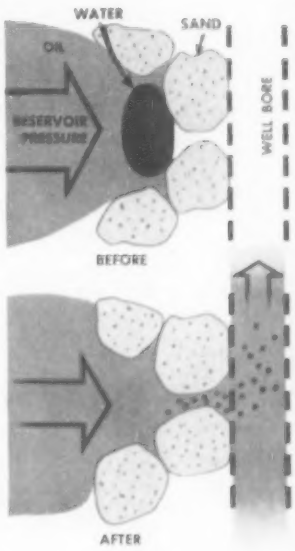
The McCullough Tool Co. has opened a new service branch in Carmi, Ill., to provide services to the oil industry in the Illinois basin.

R. B. Bown has been appointed manager of this new branch office. He was transferred from the McCullough Eastern division headquarters at Houston where he has served as division safety engineer. Bown's experience includes several years of experimental work in the McCullough laboratories in the development of jet-perforating and cutting tools, and a trek to South America to help indoctrinate McCullough's foreign distributors and customers in the operation of McCullough's wire-line services.

According to vice president O. J. McCullough, the Illinois branch was established because of increased activity in the Illinois basin. A complete staff of experienced personnel has been selected to man the new branch.

Improve Oil Production with PR-277

a surface-active agent for use in water-block removal



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EXPLORATION

New Brunswick— Ninety-Six Years Later

by Frank J. Gardner

Canada's oldest oil area is in line for a vigorous exploration campaign as result of success at Stony Creek field.

"BOYS, we're all through. Line up and get paid off. Colonel Drake has struck oil and his well is giving 25 bbl. a day. There's only room for one real oil well in North America!"

Unquote Dr. H. C. Tweedel, September 1859. He had just finished four wells, the deepest at 190 ft., and was on his fifth. He'd found oil and gas, but was having water troubles. Then the news reached him that Drake, his bitter rival in earlier days, had beat him to the punch.

Tweedel chose to drill at Dover, in eastern New Brunswick, on the basis of oil seepages he'd heard of there. He was a chemist, but he knew a smattering of geology. When the Pennsylvania Rock Oil Co. chose Drake over him to supervise the first serious search for oil in the United States, he left in a huff, vowing to beat Drake in the race. He failed, but he did give Canada its first oil field.

An exploration stepchild . . . Last fall, in one of the most interesting exploration deals in recent years, Tweedel's original properties changed hands. The details of the lease arrangement are described on page 63 in this issue of the Journal. But the geological aspects are just as intriguing, for they point to a sparsely explored oil province that merits further study. Eastern Canada has been an exploration stepchild since the western campaigns began, but in the past 2 years there's been an increasing interest in the prospects for this oldest of North American oil provinces. None of the six sedimentary basins of eastern Canada can compare with the great western Canadian basin, but their past productive histories and the meager amount of exploration they've seen paint a picture of neglect.

And an independent oil man . . . Orville H. Parker, an independent oil man from Oklahoma, by applying modern completion techniques, is reviving production in the old Stony Creek field of Albert County, New Brunswick. His 10,000-sq.-mile lease from the British crown includes Tweedel's old Dover field, across the Petitcodiac River from Stony Creek (see map). His first successful well is not a discovery in the true sense of the word. But by recording (in preliminary tests) the largest oil flow ever encountered in New Brunswick, he has demonstrated the discovery potential of sharp speculative geology in old, neglected areas.

Parker's first oiler lies at the southeast end of Stony Creek field, discovered in 1909 by New Brunswick Gas & Oil Fields, Ltd. It is an infill well halfway between two old producers. Initial flows into the well bore before fracturing amounted to 108 bbl. per day from Albert-Mississippian sand at 2,905 ft. After selective fracturing of several likely sands, the operator expects a still greater potential.

The multiple-sand sequence in this old field is a promising one, and it's never been properly exploited. The Albert formation here consists of alternating sands and shales, and no well in the field has found fewer than four prospective oil pays. These vary in thickness from 6 or 8 ft. to as much as 275 ft. The Parker well itself had a total of 135 ft. of saturated sand, 90 ft. of which is expected to be effective pay. These oil sands lie between 2,706 ft. and total depth of 2,989 ft. Rotary drilling, Parker believes, would bypass many of these prospective pays, so he sticks to cable tools in his program.

Of 135 wells drilled at Stony Creek, 111 were producers (25 oil and 86 gas). Initially, the gassers made an average 4,000 M.c.f. per day, and the oilers 15 bbl. per day of 36°-37° crude. At present, total field production is only 300 bbl. per week, or about 12 bbl. per week per well. By proper methods of cleanout, fracture, and pumping, Parker is certain he can rejuvenate the field. After that, he will commence a wildcat campaign over the remaining part of his huge concession.

Combine forces . . . Structurally, Stony Creek is a stratigraphic pinchout against the Westmorland uplift to the north. The Albert sands dip southward off the uplift at 1,500 ft. per mile, and production is controlled by lenticularity of the oil sands. Similar conditions exist at Dover, and Parker's geologists believe that subsurface study of the Maritimes basin will uncover many other strat traps.

Eastern New Brunswick lies within the Maritimes basin, where the prospective rocks for oil are Mississippian and Pennsylvanian in age. The Mississippian deposits hold the greater promise because of their marine to brackish nature, and it is from them that all oil found to date has come. The Pennsylvanian beds are largely nonmarine and offer less hope for oil and gas. Pre-Pennsylvanian rocks are believed to have been too greatly altered by Acadian diastrophism to have producing possibilities.

Tectonically, the Maritime provinces are a part of the Appalachian system, and stratigraphic and structural conditions are very complex, but the 15,000 cu. miles of Carboniferous sediments under the land areas offer substantial hope for both structural and stratigraphic oil traps. Seepages of oil and gas are quite common, and the majority of wells drilled in New Brunswick have had showings of some kind. The localization of structure and detection of strat pinchouts should produce some nice oil fields if exploratory interest can be sustained.

It must be remembered that only about 30 real wildcats have been drilled in the entire Maritimes basin since Stony Creek was found in 1909. Of these, only eight reached the lower Mississippian. Operations in both exploration and drilling are difficult because of remoteness from service and supply houses, but those things have never yet stopped an aggressive wildcatter. They didn't bother Tweedel in 1859. They don't bother Parker in 1955.

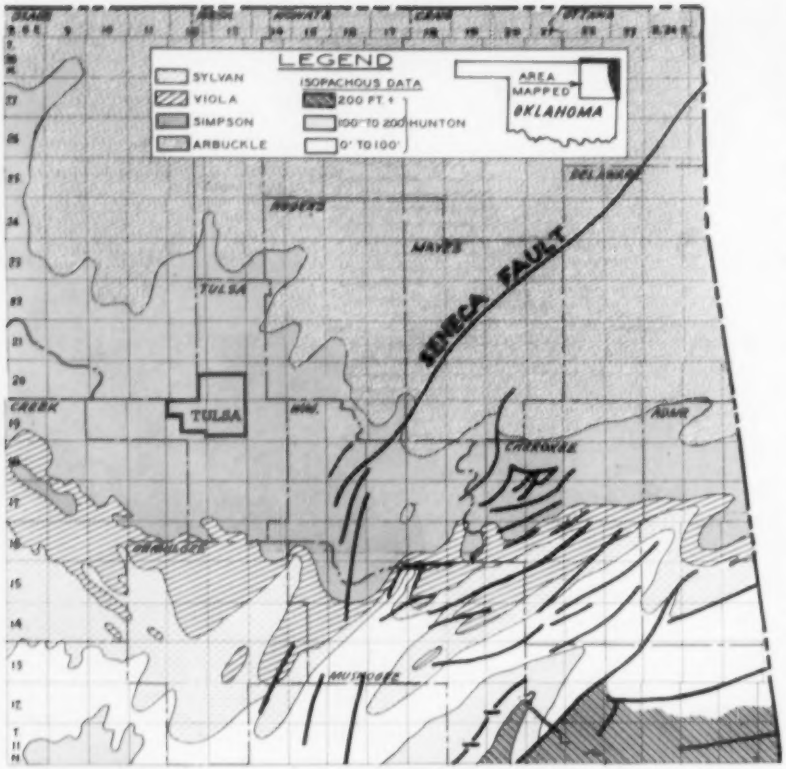

Fig. 1—Pre-Mississippian subcrop map of northeastern Oklahoma reveals several promising areas for oil exploration.

Deeper Zones Offer Promise In Northeastern Oklahoma

Before you write off Northeast Oklahoma as played-out oil country, remember that few wells have been drilled there below 1,600 ft. Yet, as this article points out, several pay zones occur between 2,000 and 4,000 ft. which may well have rich reserves. Here's a brief production history of this area and an analysis of future possibilities.

by R. C. Tuttle

PRE-MISSISSIPPIAN beds should produce over a wide area in northeastern Oklahoma. Engineers give ultimate recoveries of 60,000 to 100,000 bbl. per well to many of the Simpson and Arbuckle wells in the area. Typical Pennsylvanian sand wells will produce only about half these amounts according to best reports.

From the time of the first oil well in Tulsa County in 1901 until the drilling decline in the 1920's, oil was found mainly by surface geology and "creekology." Since that time the few local operators who have drilled in the area have been finding oil by subsurface geology and by playing sand trends. With the advent of sand-oil treatments and water flooding, these operators and others have been redrilling in the old pools with considerable success. A great number of the tests, however, have been to the top of the Mississippi lime and no deeper. Cable tools are still being used and the depths rarely exceed 1,600 ft.

The author is consulting geologist, Tulsa.

Arbuckle production . . . There are 196 oil and gas pools that have produced from the Arbuckle in northeastern Oklahoma. But most of these pools are found in Osage County and the remainder of the 14,000 sq. miles has very little pre-Mississippian production. The thickness of the Arbuckle ranges from 0 to 1,600 ft. The direction of thickening for the entire section is towards the northeast and towards the southeast. The uplift of the Ozarks apparently was very pronounced at the close of the Cambrian time. From then until recent times this area has been repeatedly uplifted and eroded and submerged. As a result there are many unconformities throughout the section that provide traps for oil.

Structure . . . Numerous faults extend upward from the pre-Cambrian. Most of these faults apparently die out in late Cherokee time. Others extend farther up in the Pennsylvanian and a few are found at the surface. The majority of the deep-seated faults found at the surface are in the vicinity of the Seneca fault (Fig. 1). The many surface faults found west of the Seneca fault and especially in Osage County are usually tensional expressions of the deeper faults. Both of these types of faults show there was rejuvenation in the ancient fault patterns.

In the area of northeastern Oklahoma that covers 14,000 sq. miles, there are only 68 tests known to have reached pre-Cambrian granite. There are 24 granite peaks showing less than 300 ft. of Arbuckle. There are 20 or more subsurface highs with no tests to the granite where the Arbuckle is probably less than 300 ft. thick. These old granite highs are not intrusive plugs but appear to be more in the nature of faulted granite blocks. It is believed that the sedimentary mantles have been eroded with each uplift and the following period of peneplanation. Oil may be trapped on the flanks of these granite uplifts or highs.

Recoveries . . . Some excellent recoveries have been reported in a large number of Arbuckle pools in northeastern Oklahoma. A high average ultimate recovery of 100,000 bbl. per well compares very favorably with a high recovery of 45,000 bbl. per well in most Pennsylvanian sand wells. The top of the Arbuckle over most of northeastern Oklahoma is found from 1,000 to about 3,000 ft. in drilling depth. The chances of finding commercial production at drilling depths above 4,000 ft. are good. In addition, recoveries from Simpson sand wells are high, judging from the performance of present producing wells in the area. Within the Arbuckle itself there are eight unconformities that may serve to trap oil. There are innumerable possible reservoirs in the porous zones of

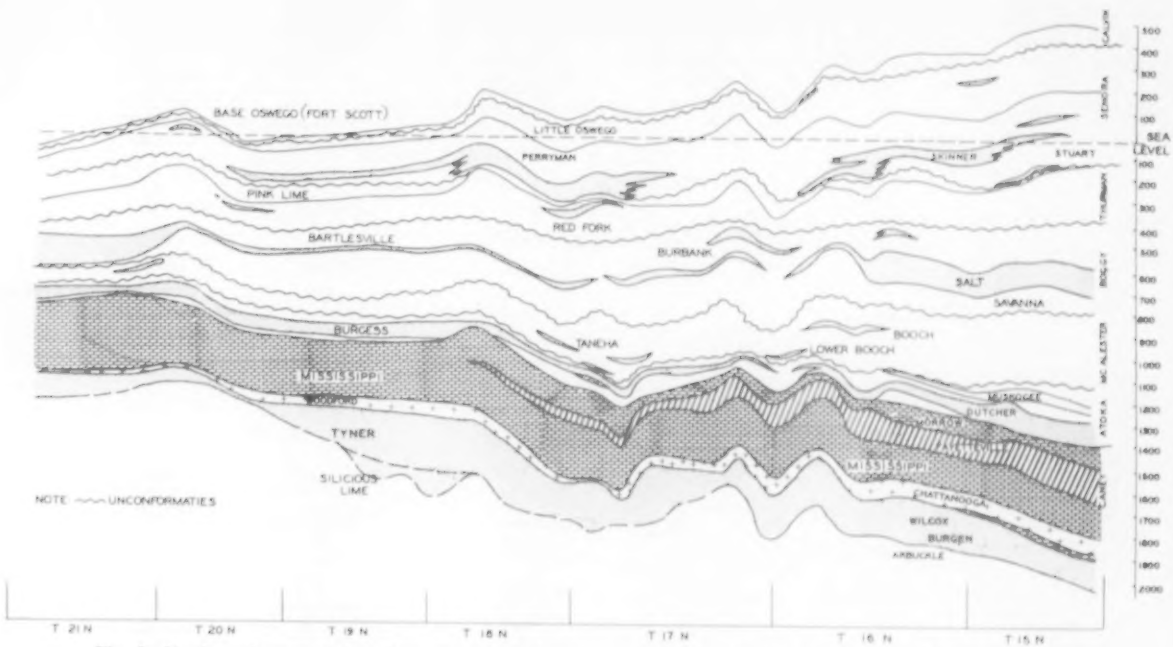

Fig. 2—North-south cross-section shows the principal pay zones; line of section is through Range 13 East, Tulsa County.

the sands, cherts, dolomites, limestones, and oolite zones. Oil has been found in the fractured cavernous dolomites and limestones.

History of area around Tulsa . . . Prior to the discovery of Wilcox production near Bixby, in April 1914, most of the production in Tulsa County was from the Bartlesville and Red Fork sands. The most prolific wells in northeastern Oklahoma, however, have been found in the Wilcox and Arbuckle. Several wells have had initial potentials ranging as high as 8,000 bbl. per day in the Arbuckle and 5,000 bbl. in the Wilcox.

The first commercial production in Osage County, Oklahoma, was in June 1897. Tulsa County experienced an oil boom beginning with the discovery well in 1901. Activity, however, declined in the area around Tulsa with the drilling booms in Burbank in 1920-21 in Osage County.

During the early work many uncalled-for dry holes were drilled. This was due to flagrant speculation along with the rapid declines in production because conservation was unknown. This gave Tulsa and northeastern Oklahoma an unwarranted stigma. Most of the early wells never went deeper than the Wilcox or Misener sand. The few tests that drilled in the deeper horizons were usually edge wells which had failed to find commercial oil in the shallow zones. These tests being structurally low were doomed to find water in the lower levels.

Numerous closed highs in northeastern Oklahoma have no deep tests within their closures. This is one of the reasons why Tulsa County and the surrounding area afford one of the most likely areas in which to find Ordovician and Cambro-Ordovician production. High wells that were abandoned because of a hole full of water in the first sand are surrounded by pools which produce oil from Tyner, Burgen, and Arbuckle. Several wells and pools in the area show water in the Wilcox or Tyner but are prolific producers in the Burgen or Arbuckle. Sometimes the Burgen and Misener are water-bearing with oil in the Tyner and Arbuckle. Again, only the Arbuckle may be productive.

The seeming erratic initial production in structurally high wells or offsets could have been for two reasons. The porosity or fracturing in the reservoir rocks was not the same in all wells. The other reason is poor completion methods. All wells in the early days were usually completed alike regardless of the individual character of the pay zone. Shooting might improve the production in one well whereas another well could be ruined by the same method. As a rule, a completion meant get as much oil to the tanks as the well could possibly produce. Time after time gullies and ravines were dammed up to hold the oil from big wells. Oil was moved from these earthen tanks at a later time.

Producing zones . . . The various names given to the reservoir rocks are confusing to newcomers in the area (Fig. 2). It is but recently that the geologists have tried to standardize the nomenclature. The old names still persist with some of the old timers and operators (see Fig. 2). There is some overlapping of names but all in all the old-time drillers did a remarkable job with the information at hand.

Finding the pre-Pennsylvanian structures will be a difficult job in northeastern Oklahoma. The "Mississippi lime" in the area around Tulsa very probably contains representatives of Pennsylvanian Morrow or Atoka. When these Pennsylvanian limestones rest directly on or very near the top of the Mississippian, it was called Mississippi by the early operators and reported as such in the logs. Subsurface mapping on top of the "Mississippi lime" would therefore be misleading to deeper structures, except on some of the more pronounced features.

Granite occurs above 4,000 ft. throughout most of the area and in some instances may be encountered in as shallow as 3,000 ft. This makes seismic mapping very difficult; however, new techniques that have been devised should be able to map these postulated Arbuckle and Simpson structures. Gravity and magnetic work will aid in pin pointing the positive areas, and there is enough subsurface control to indicate areas of interest.

Reference

Additional information on this area will be found in USGS Prelim map No. 52 by H. A. Ireland, "Maps of Northeastern Oklahoma and Parts of Adjacent States Showing the Thickness and Subsurface Distribution of Lower Ordovician and Upper Cambrian Rocks."

EXPLORATION HIGHLIGHTS

MID-CONTINENT

KANSAS

Hourly Flow Reported At Barber County Test

Lion Oil Co. and Gulf Oil Corp. have a new discovery in Barber County. It is the 1 Brooks-Younger in SW NW NW 23-32s-13w, 2 miles northwest of North Medicine Lodge field.

The well flowed at the rate of 16 bbl. of oil per hour plus 3,000 M.c.f. of gas per day on test of the Mississippian at 4,423-28 ft. The formation was fractured.

Reno Discovery Testing In Viola Lime Section

The 1 Hornbaker, SE NE NE 29-25s-6w, Reno County, is a new discovery for the Castleton area, 4 miles northwest of North Albion field. The Globe Oil & Refining Co. wildcat swabbed 1.83 bbl. of oil per hour on test of the Viola lime at 3,992-98 ft. Oil was previously recovered on a drill-stem test at 3,983-4,002 ft.

OKLAHOMA

Viola Discovery at North Marietta Nearing Completion

Frankfort Oil Co. is near completion at its important Viola lime discovery in Love County's North Marietta area. The 1 Conrad, NW NW NW 34-6s-2e, swabbed 11 bbl. of oil in 3 hours from Viola perforations at 6,130-80 ft. After fracture treatment the test made 94 bbl. in 13 hours and 174 bbl. in 24 hours.

Northeast Falls Field Gets Its Third Producer

Herman Brown 1 Forrest-Mouser, SE NE NE 20-9n-1w, is the third oil well in new Northeast Falls pool, Cleveland County, south-central Oklahoma.

The well flowed 191 bbl. per day from the second Wilcox sand through open hole at 7,174-84 ft. Flow was on 10/64-in. choke.

West Short Junction . . . Continental Oil Co. 2 Fry, C NE NE 22-10n-4w, is a new Hunton oil well on the east side of this Cleveland County pool. Treated perforations at 8,024-96 ft. flowed 150 bbl. of 37°-gravity oil in 6 hours on 20/64-in. choke.

Low Gravity Oil Strike Hinted Near Cement Field

A low-gravity oil discovery is in the mill near Cement field in Caddo County. It is Frankfort Oil Co.'s 1 Black Bear, SE NE NE 9-5n-10w. A drill-stem test at 3,644-53 ft. got 100 ft. of 25°-gravity oil and 30 ft. of mud-cut oil. Another test was taken at 3,657-98 ft. got 100 ft. of 25° gravity oil and 30 ft. of mud-cut oil. Another test was taken at 3,657-89 getting 210 ft. of muddy salt water. This wildcat prospect is about 1 mile south of West Cement field production.

Sterling Proves New Zone In Oklahoma Discovery

Wilcox sand has been proved as a new producing zone for East Spring Valley field, Garfield County, Oklahoma by Sterling Oil of Oklahoma, Inc.

The zone discovery, the firm's 1 Rogers, SE NE SW 17-23n-4w, flowed at a rate of 240 bbl. daily, without water, through a 23/64-in. choke on completion test. Production was nat-

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ural through perforations between 6,100 and 6,120 ft. opposite first Wilcox sand. Application has been made for a testing allowable as a zone discovery.

Sterling's new completion gives East Spring Valley its first production from this formation; prior drilling being chiefly for gas-distillate production in the Mississippi lime. The 1 Rogers also had the Mississippi pay section and plans are to dually complete the well.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

New Interest Shifts to Northwest Panhandle Region

The far northwestern section of the Texas Panhandle is coming into its own in exploratory interest.

Dallam County is in for a 7,000-ft. granite test 22 miles northwest of Dalhart and 28 miles southwest of nearest production at Kerrick-Cisco gas field. The new try will be D. D. Harrington 1 Brown & Tovrea "A", Section 28, Block 8, CSS Subdivision. There are three wildcats active in Dallam County. Harrington, Marsh & Wagner have a test going at 1 Joe M. Scott, Jr. "A", 9 miles northeast of Dalhart in Section 34, Block 1, B&B Survey. Shamrock Oil & Gas Corp. 1 Skaer, is a ¾-mile southeast extension attempt to the recent Cisco gas strike northwest of Stratford 7 miles.

Hartley County . . . This Dalhart basin county has three wildcats going. One is Clark Drilling Co. 1 Martin, Section 10, Block A-1, PSL Survey. It is drilling below 3,775 ft. Location is 13 miles northwest of Middlewater. W. H. Taylor et al 1 Taylor "H", 3 miles west of Middlewater, is drilling below 2,100 ft. Standard of Texas 1 Alice Walker is drilling below 3,397 ft. This well is ½ mile northwest of the only production in the area at 1 Guilloud. Pennsylvanian granite wash production was established at that well in 1954, opening first oil production in the Dalhart basin.

Hansford County Gets Oswego Gas Production

Coats Drilling Co., Inc. 1 S. P. Miller Estate, Section 5, Block 2, PSL Survey, is an important Oswego-Des Moines gas discovery for north-central Hansford County.

The estimated open flow potential of the big gasser was 32,000 M.c.f. per day plus 9 bbl. of distillate per million. Perforations were at 6,156-79 ft. The

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Miller discovery gives the Texas Panhandle its first big Oswego production. The underlying formation, the Cherokee, is a prolific pay zone at North Hansford field 4 miles to the southeast.

SOUTHWEST KANSAS

Morrow Oil Strike in Meade County Shutin

Colorado Oil & Gas Co. 1-3 Leslie, 2 miles north of Northeast Bruno-Morrow oil and gas field, is shutin for

storage space after flowing 11 bbl. per hour on 16/64-in. choke. This new Morrow oil strike, which revived sleepy activity in Meade County, is in SW NE 30-33s-30w.

Morrow Gas Production at Sparks Field Is Extended

Morrow gas production in Sparks field, Stanton County, has been extended at Superior Oil Co. 1 Hume Unit, 9 miles south of Manter in C NE 5-31s-42w, just across into Morton County. The extension well is 1 mile south of the field itself. The well was completed flowing 5,210 M.c.f. of gas per day. Sparks was opened last year at J. M. Huber Corp. 1 Sparks, C NE 34-30s-42w. The Morrow gas strike flowed 15,600 M.c.f. per day. Location is 10 miles west of Hugoton field's limits. The new well gives the field two producers.

OKLAHOMA PANHANDLE

Southeastern Beaver Area Given New Success Promise

Production for southeastern Beaver County is hinted at a remote wildcat test in SW SW 3-2n-27eCM, 16 miles southeast of nearest production at Southwest Camp Creek field.

The promising wildcat is Colorado Oil & Gas Co. 1-3 Armstrong, 1 mile north of Madison. Both oil and gas shows were reported on drill-stem test in the Morrow at 7,554-58 ft.

"Inside Hugoton" Morrow Strike Reports Good Flow

The well that established first Morrow production inside the Oklahoma portion of vast Hugoton field is assured good gas production from that zone. The well is Oceanic Oil Co. 1-A Swinger, SW NE 20-6n-16eCM.

The well, 8 miles northwest of Hooker, reported an estimated flow of 20,000 M.c.f. of gas per day from perforations in the Morrow sand at 6,484-6,500 ft.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Terry County Devonian Discovery Flows on DST

West central Terry County was assured of a Devonian discovery at The Texas Co. 1 Spradling, located in 115-D11-C&M Survey. A drill-stem test covering the first 6 ft. of the Devonian flowed a total of 73 bbl. of oil in 2 hours.

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Operators at 1 Spradling drilled into the Devonian at 12,678 ft. on elevation of 3,406 ft. A 3-hour and 45 minute test at 12,670-84 ft. flowed water blanket in 1 hour and 25 minutes, mud in 90 minutes and oil in 1 hour and 45 minutes. The first hour of flow was 40 bbl. of clean oil, under pressure of 2,145-4,905 psi. Choke sizes were not reported. Recovery in the pipe included 10 ft. of sulfur water.

Humble Ector strike tested . . . Humble Oil & Refining Co. 1 Barrow, Ellenburger discovery 2 miles northwest of Ratliff-Ellenburger field, has been completed for 561.15 bbl. Production

Humble 1 Barrow ran flat on the Ellenburger with Ratliff discovery, and may prove to be an extension.

was through ½-in. choke, from perforations at 13,578-13,608 ft. Completion was without acid treatment. Gravity was 50°, gas-oil ratio 872:1, and tubing pressure 150 psi.

Toyah gas field . . . Gulf Oil Corp. and Phillips Petroleum Co. 1-KK Toyah Unit, ½-mile northeast extension try to a recent Siluro-Devonian gas discovery, was coring ahead in the Devonian below 12,591 ft. Initial core in the formation at 12,541-91 ft. recovered 50 ft. of shale and dolomite, having small fractures in the top 45 ft. with no shows; the bottom 5 ft. was dolomite with a fair odor.

The same operators' 1-MM Toyah Unit, a northwest stepout from 1-KK, was drilling below 10,055 ft., after running into lost-circulation trouble around 9,978 ft.

ARK-LA-TEX

EAST TEXAS

Deep Wildcat to Be Drilled in Franklin County

Northern Franklin County gained a new wildcat which will seek pay in the Travis Peak, but may go on to the

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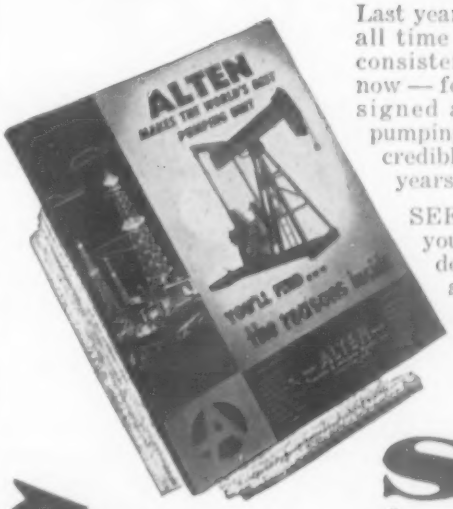

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Smackover if the first objective is dry, and the well shows promising structures.

The project is Purnell & Coleman and Trant Drilling Co., Tyler, 1 Bob Campbell. Location is 4 miles south and slightly west of Talco field, in Samuel Carson Survey, A-118. Drilling permit was for 9,400 ft. The Travis Peak is expected around 6,700 ft.

No. 1 Campbell is on a farmout from The Texas Co. Humble Oil & Refining Co. and American Liberty Oil Co. are supporting the venture.

Cass County . . . Sam Sklar 1 W. C. Williams, 8 miles southeast of Atlanta and 1 mile north of production in Rodessa field, developed oil on a drillstem test of the Rodessa. A 5-minute test at 5,927-60 ft. recovered 60 stands of 42° oil. Operators then drilled to 6,140 ft. and ran casing for production tests.

Southeastern Cass County was in line for a 7,600-ft. Travis Peak test by Sunray-Mid-Continent Oil Co., Carter-Jones Drilling Co. and G. C. Clark, Tyler. Their 1 Grogan Manufacturing Co. is located on a tract obtained from Stanolind Oil & Gas Co., in the William Donaho Survey, 5 miles northeast of Kildare field.

Anderson County . . . Douglas & Grelling, San Antonio and Tyler, have announced another wildcat in the vicinity of their 1 W. T. Bridges, which was showing for a possible Woodbine discovery.

The new test will be 1 Shaver, in the Robert Erwin Survey, A-262. Location is 5 miles northeast of Elkhart and a long southwest stepout to 1 Bridges. The latter well developed 20 ft. of oil on a test at 5,370-5,412 ft.

NORTH LOUISIANA

Two-Smackover Zone Well Completed in Claiborne

A Stanolind Oil & Gas Co. wildcat in Claiborne Parish, Louisiana, has been completed as a flowing well from two zones in the Smackover sand.

Stanolind 1 Bell Unit flowed 35 bbl. of oil in 2 hours on 10/64-in. choke from the A zone and 21 bbl. of oil in 2 hours on 12/64-in. choke from the Smackover B zone. Calculated daily potential of A-zone production is 418 bbl. and from the B zone, 249 bbl. Gravity of the A-zone oil is 47.4°, and that of the B-zone oil, 49.8°.

Total depth of the well is 10,756 ft., plugged back to 10,702 ft. The Smackover A was topped at 10,200 ft. and the B at 10,456 ft. The A is perforated at three different intervals from 10,220 ft. to 10,386 ft. and the B at

four intervals from 10,506 ft. to 10,649 ft.

Stanolind has 2,500 acres in the vicinity of the well, which is located in 5-22n-5w, Claiborne Parish.

May Exploration

The big, fast-growing Bethany-Longstreet area of East Texas-Western Louisiana hightlighted May exploration in North Louisiana.

Latex Oil & Gas Co., Inc. got a dual oil strike at a DeSota Parish wildcat, the 1 Atkinson Heirs Unit, 35-14n-15w, 2 miles southeast of Keatchie. The discovery well flowed 789 bbl. of oil per day from the Page zone and 525 bbl. per day from the Pettit. The zone between the Pettit and Travis Peak made 264 bbl. of oil per day.

This oil discovery is of considerable importance to DeSoto Parish. There are only a few oil wells in the primarily gas-condensate producing region. These are at Logansport field 11 miles to the southwest.

Spider field . . . This DeSoto Parish field was extended 1¼ miles north at McAlester Fuel Co. 1-A Blanche Story et al, 17-12n-14w. The well made only 13 bbl. per day on pump from the Paluxy sand at 2,749-56 ft. However, another well in 16-12n-14w, ½ mile northeast, made 150 bbl. daily from 2,872-78 ft. in the Paluxy, improving the prospects of the new extension area.

GULF COAST

SOUTHWEST TEXAS

New Field Indicated in Wilson County Discovery

Discovery of another new field, located 1 mile north of Poth, in Wilson County, is indicated by showings encountered by Seaboard Oil Co. in its 1 Bednarz, a wildcat in the Luis Manachacha Survey.

Gas showed on the mud logger while hole was drilling at 5,861 ft. A 10-minute drill-stem test then was run, taking in from 5,847 ft. to bottom of hole. Recovery through ¼-in. chokes was 480 ft. of clean, 28.5°-gravity oil and 270 ft. of oil-cut mud (50 per cent oil). Maximum flowing pressure was 1,785 psi.

Hole is being cored ahead, with original objective being 7,500 ft.

Pumper Opens Duval Field

Sunray Mid-Continent Oil Co. has a new discovery well in Duval County. Its 1 Ramon, 7½ miles northwest of Santa Cruz, in the La Huerta Grant, pumped 84 bbl. of 26°-gravity oil (net) in 24 hours on completion gage, making 21 bbl. of water. Pay is perforated at 3,100-18 ft. Total depth is 6,500 ft.

New Producer Extends Pearsall Chalk Area

Austin chalk production in Pearsall field, Frio County, has been extended southward with a 355-bbl. oil well completed by Armstrong & Horn. The well, 1 Vaughn & Jackson, was tested through ⅛-in. choke, gaging 820-psi. pressure on the tubing and 955 psi. on the casing. Gas-oil ratio is 400 cu. ft. per barrel. Pay is in open hole at 5,302-5,603 ft. Location is 1 mile southeast of Pearsall, in Pedro Flores Morales Survey 1413. Hole had been abandoned at 4,092 ft. in April 1954.

Queen City Production Found at South Imogene

Queen City production has been opened in South Imogene field, 4 miles southeast of Jourdanton, in Atascosa County. Discovery well is Frio Production Co. 1 Easterwood, completed pumping 51.98 bbl. of 20°-gravity oil per day from pay at 1,597-1,601 ft. Other production in the field is from deeper Reklaw and Carrizo sands. Hole was drilled to 1,795 ft. Location is in Block 441, Simmons Subdivision, Section 29.

TEXAS GULF COAST

Gas Production Uncovered By Hungerford Wildcat

Potential tests rate Texas Gulf Sulphur Co.'s new discovery well, 1 Dora Hudgins, 2 miles north of Hungerford, in northeastern Wharton County, good for 72,000,000 cu. ft. of gas daily. The well is shut in with pressure of 1,848 psi. Gas is dry. Production is from upper Frio sand, perforated at 4,766-76 ft. Location, in the Alexander Jackson Prairie League, is 1½ miles northeast of Spanish Camp field, and about the same distance west of the Hungerford area. Texas Gulf is starting another outpost test 2 miles northwest, and about 1¾ miles north of Spanish Camp production.

Refugio Wildcat Gets Gas

Humble Oil & Refining Co. has opened a new dry-gas area in Refugio County near the Bee County line. Its discovery well, 1 J. F. Welder heirs, in the Martin Power Survey, flowed at the rate of 9,000,000 cu. ft. of gas per day, open flow, on potential gage. Pay is perforated at 5,064-70 ft. Location

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is 5 miles west of Woodsboro. It is 3 miles northwest of Roche field, nearest production.

New Condensate Discovery

Lloyd H. Smith, Inc., has completed his 1 Elma Sweiger, gas-condensate discovery well southwest of Rock Island, in Colorado County. Open-flow potential is placed at 12,000,000 cu. ft. of gas per day. Condensate recovery is 74 bbl. per million cubic feet. Pay is perforated at 8,548-76 ft. Location is 2 miles north of Sheridan field.

SOUTH LOUISIANA

Six Fields Extend Limits With Outpost Completions

Productive areas of at least six coastal Louisiana fields are being extended by new step-out completions.

In the Cow Pen Creek area, southeastern Beauregard Parish, Magnolia Petroleum Co. has a new well ½ mile east of production at its 1 J. A. Bel, in 16-6s-9w. It flowed 60 bbl. of 40.4°-gravity oil per day through 7/64-in. choke from perforations at 8,538-45 ft. Its flowing pressure was 3,000 psi., and gas-oil ratio 500 cu. ft per barrel.

At North Elton, in southeastern Allen Parish, Bel Oil Corp. completed its 1 Rees as a gas-condensate well from perforations at 8,180-88 ft. It is ½ mile northeast of the field. Gage was 565,000 cu. ft. of gas per day through ⅛-in. choke. Gas carried 64°-gravity condensate in the ratio of 25,000 cu. ft. per barrel. Pressure was 2,525 psi.

J. P. Owen 1-B Kerr, northeast of production at Ellis, in Acadia Parish, flowed 61 bbl. of condensate with 910,364 cu. ft. of gas per day while on ⅛-in. choke. Perforated interval is 11,666-11,712 ft. Flow was under pressure of 7,375 psi.

Sinclair Oil & Gas Co. is extending production at Live Oak, in southern Vermilion Parish, another ½ mile southwestward at its 1 Broussard et al. The well, completed from perforations at 13,174-82 ft. is rated good for 52,000,000 cu. ft. of gas per day, open flow, with condensate recovery of 27½ bbl. per million cubic feet. Flowing pressure gaged 4,750 psi. Nearest well is Houston Oil Co.'s 1 Pierce, completion of which last February extended the field a mile southwest.

At Bayou Long, in St. Martin Parish, Continental Oil Co. 4-B Jeanerette, ¾ mile north of production, flowed 144 bbl. of oil per day through 7/32-in. choke under 3,875-psi. pressure while testing perforations at 11,844-56 ft., a new pay zone for the area.

Northeast of Lirette field, in Terre-

bonne Parish, Humble Oil & Refining Co. has completed its 1-B H. J. Ellender as a gas-condensate well in sand at 10,148-52 ft. It flowed at the rate of 5,100,000 cu. ft. of gas and 7.44 bbl. of 48.8°-gravity condensate per day through ¼-in. choke under pressure of 3,250 psi. Previously, from sand at 10,850-64 ft. it flowed initially at the rate of 140 bbl. of oil per day, but later went to water and was plugged back.

EASTERN INTERIOR

ILLINOIS

Illinois Oil Production Up in May

Illinois oil production continued its upward climb in May, averaging nearly 222,000 bbl. of oil per day, according to the Illinois State Geological Survey, State Department of Registration and Education. This is the highest production so far this year, topping the April production by about 4,500 bbl. per day.

For the first time, Saline County led in drilling activity, completing 27 producing wells and 9 dry holes. Eldorado Consolidated pool was the chief center of activity, with 31 completions, 26 of which were producing wells. White County dropped to second place with 24 producing wells and 9 dry holes.

The May drilling report, released June 10, reports no new pools, but lists extensions to the following four pools: Shawneetown East in Gallatin County, Eldorado Consolidated in Saline County, Iola Consolidated in Clay County, and Hill East in Effingham County.

The May report also lists four new pays, as follows: the Waltersburg sandstone in the extension to Shawneetown East pool in Gallatin County, Bethel sandstone in Irvington East pool in Jefferson County, St. Louis limestone in Exchange East pool in Marion County, and Bethel sandstone in Omaha pool in Gallatin County. Maunie North and Maunie West pools were consolidated and will be called Maunie North Consolidated.

The boundary between Lawrence pool in Lawrence County and Main Consolidated pool in Crawford and Lawrence counties has been redefined so that in Townships 4 and 5 North and Ranges 12 and 13 West the Embarrass River will be the dividing line.

During May the industry completed 144 oil wells and 1 gas well out of a total of 258 completions.

Among the larger wells completed in

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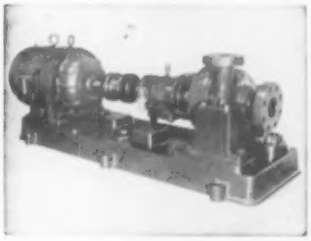

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WINFIELD, KANSAS

May were four in Eldorado Consolidated in Saline County with initial productions of 1,680, 1,540, 1,500, and 1,465 bbl. of oil, all producing from the Waltersburg sandstone.

A well in the Edinburg West pool in Christian County came in with an initial production of 672 bbl. of oil from the Silurian dolomite. The well which extended Iola Consolidated pool in Clay County had an initial production of 513 bbl. of oil from the Rosiclare sandstone. The well is ¾ mile east of the nearest production in the pool.

In Edwards County Cullum and Lawhead are pump-testing their 1 Nellie Horn in NE NW SE 20-2s-10e, 4 miles southwest of Albion. The Aux Vases discovery pumped at the rate of 180 bbl. per day from 3,190-3,201 ft. This is a 1-mile east extension to Ellery field.

● In Christian County Lama Oil Co. has set casing to test at 1,782-1,803 ft. in the Harding sand at the 1 Hibbard, NW NE SW 3-13n-3w. This discovery, 3 miles from production, is 5 miles northwest of Taylorville.

● Coy Oil Co. has finaled a Clay County discovery 3 miles north of Sailor Springs. It is the 1 Katie G. Stanley in NW SW SE 2-4n-7e. The new-pay strike is pumping 102 bbl. per day.

● Calstar Petroleum Co. 1 William D. Stephens, SW NE SW 16-5s-7e, 5 miles east of McLeansboro is a new Hamilton County discovery. Production is indicated at the 1-mile wildcat from the Cypress sand at 3,028-52 ft.

GREAT LAKES

MICHIGAN

● A large sand fracturing treatment of a Dundee oil pay appeared to have increased production very satisfactorily in the new Birch Run Dundee oil pool, Birch Run Township, Saginaw County. New well in the field, west offset to the Dundee horizon discovery well, is the J. V. Wicklund, Jr. 2 Morse, W½ SE NW 20-10n-6e. Production was boosted to an initial after fracturing of about 70 bbl. of oil a day, no water, from a natural rating of 1 bbl. of oil daily. There was no evidence of a rapid decline after well had been flowed and swabbed through casing for about 4 days after well went on net production. Tubing has been run and production will be restricted. Dundee top was logged at 2,531 ft. and hole was drilled to 2,608 ft., total depth. Pays showed at 2,541-43 ft., 2,562-64 ft. and at 2,585-90 ft. Pay were fractured with 10,000 gal. of oil and 20,000 lb. of sand.

● Wicklund will rework the 1 Morse discovery well, E½ SE NW 20-10n-6e, before starting next new well at the south 20-acre offset to the discovery in the next 3 weeks. The discovery producer was fractured with a smaller treatment, and operator believes that production may be boosted substantially by a larger fracture shot. A plug-back in the Dundee from 2,598 to 2,565 ft., will be drilled out before well is refractured. Plug was originally set when water showed which was first believed to be bottom-hole fluid. Later tests proved that water showing in the discovery was due to a leak in 5-in. casing. The casing has since been cemented to eliminate leak.

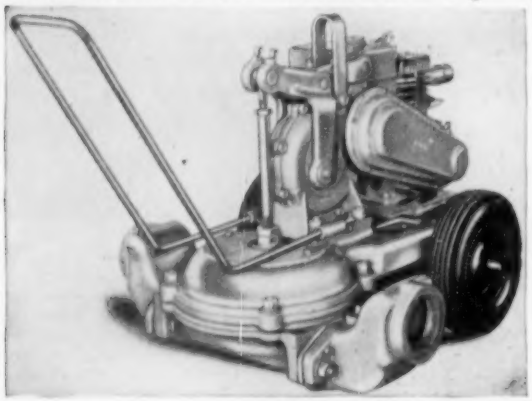
APPALACHIAN

WEST VIRGINIA

In Licking district, Tucker County, West Virginia, Hope Natural Gas Co. located 9942 W. Asa Streets, wildcat, elevation 2,271 ft., Belington Quadrangle 1.71 miles south of latitude 39 degrees 15 minutes and 0.74 mile west of longitude 79 degrees 45 minutes.

● Sherman district, Hampshire

Two revolutionary new pumps announced by Construction Machinery Company, Waterloo, Iowa



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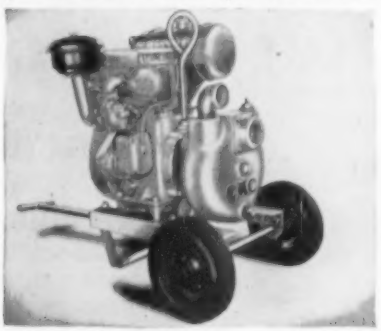

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A 1½" pumper with unique type impeller, it's excellent for such jobs as pumping through extended lines and washing equipment. Fine for suction lifts up to 25 feet.

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McKISSICK

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County, M. E. Anderson 1 J. E. & B. Orndorff is drilling at 3,738 ft.

● Dry Fork district, Randolph County, Columbian Carbon Co. 1208 D. H. Hill Arnold ran the 7-in. casing at 4,844 ft., and shut down at 4,846 ft. for cement to set. A show of gas reported at 4,838 ft., in the Oriskany sand which was topped at 4,828 ft.

PENNSYLVANIA

Unity Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. 2-4037 Fred Musnug, wildcat, elevation 2,087 ft., reached the Oriskany sand at 8,740 ft., and shut down at 8,773 ft., moving in spudder.

PACIFIC COAST

CALIFORNIA

New Gas Tests

New gas tests are planned for three Sacramento Valley counties. About 2½ miles east of Beehive Bend field in Glenn County, Humble Oil & Refining Co. will drill 2 H. C. Sannar in 4-19n-1w. Loma Alta Oil Co. will drill 2 Loma Alta in 10-20n-3e, 14 miles east of the Chico field in Butte County. A & M Oil & Gas Co. staked 2 Isom in 28-6s-8e, a rank wildcat in the Newman area of Stanislaus County.

Standard Adds New Deep Fillmore Trend

Standard Oil Co. of California was under way with a new deep wildcat in the Fillmore area of Santa Clara Valley. Its 1 Yuba Consolidated, 1½ miles northwest of production, was the fourth outpost to seek production at depths below 14,000 ft.

About 1 mile north of the four-well field Standard 2-2 Hardison ranch was fishing at 14,090 ft. Standard's other test was 1 Sespe Creek Community, some 2½ mile northeast of the field. It was drilling below 14,900 ft. About 3 miles east of the field Richfield Oil Corp 1 Homburg was nearing 11,000 ft.

New Pay for Guijarral Hills

Los Nietos Co., Oper. 65-1 Bourdieu was being completed as the discovery of an 8,400-ft. lower Miocene pay in the Guijarral Hills field of Fresno County. The new zone, designated the Sanger sand, had been tested in four wells seeking 10,500-ft. Eocene pro-

THE OIL AND GAS JOURNAL

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duction. The Los Nietos test, in NW SE 1-21s-16e, found the lenticular sand present at 8,380-8,447 ft.

New Wildcat Started Near Tejon-Grapevine

A new wildcat has been started on the leasehold of Reserve Oil & Gas Co. near Tejon-Grapevine field. This brings to nine the total number of drilling rigs now employed in the Reserve area of Tejon ranch.

The newest venture contracted by Reserve is known as the 63-20 Butler-Wehr. It is located about 2 miles north of the western area of the Tejon-Grapevine field, and about an equal distance east of Highway 99 running between Bakersfield and Los Angeles. The new wildcat was spudded on June 1 and is drilling at a depth of 3,035 ft. It is planned to test all horizons in this multi-zoned area down to about 9,000 ft.

All except one of the other eight rigs operating in the area are probing for the JV (Jewett) zone that was discovered last December. Five flowing wells have been completed in that zone to date. One of the eight rigs is on a wildcat well being drilled on Reserve's leasehold several miles east of Tejon-Grapevine field by Edwin W. Pauley. Present depth of the 56-30 well is 3,910 ft.

May Activity

A deep discovery by Shell Oil Co. in the Strand area west of Bakersfield is expected to lead to additional wildcatting around other central San Joaquin Valley fields. The discovery, 1 Posuncula, was in a 12,360-12,410-ft. upper Vedder sand, Lower Miocene age. During early June it was flowing in excess of 1,100 bbl. daily through a 20/64-in. choke. Extent of production is yet to be proved but it could be one of the most important California discoveries of recent years.

Shell Oil Co.'s 1 Posuncula in the Strand area west of Bakersfield could be one of the most important discoveries on the West Coast in several years.

● In the Guijarral Hills field of Fresno County, operators were hurriedly developing a "sleeper" sand overlooked in the development of deeper lower Miocene pays. The 8,000-ft. pay was yielding 500-bbl. producers. But because it averages only some 15 ft. it is expected to be short-lived. Its extent will probably be less than 250 acres.

New Oregon-Idaho Maps Available

The J. A. Waatti Map Co. of Casper, Wyo., has published township-range maps of the Vale-Ontario basin area of Oregon and Idaho. These maps may be ordered from J. A. Waatti Map Co., Masonic Temple Building, 105 North Center Street, Casper.

ROCKY MOUNTAIN

NEBRASKA

Western Kimball County Wildcat Successful

Empire Drilling Co. of Denver has recovered oil on tests of both "D" and "J" sands at 1 Dolcater, SW SW NE 7-16n-56w, western Kimball County. The wildcat is well west of Kimball County development. It is 10 miles northwest of production in City pool, and 12 miles south of Harrisburg field in Banner County. There has been very little previous drilling in the area. On test of "D" sand at 6,585-6,608 ft. recovery in 1 hour was 1,170 ft. of oil and 990 ft. of water. Another test in "J" sand at 6,724-42 ft. recovered 1,305 ft. of oil, 120 ft. of mud and 810 ft. of water. Tool was also open 1 hour on this test. Pressures were not reported on either test. A total of 9 ft. of apparently productive "D" sand was cored, and 18 ft. of "J" sand showed for production.

Kimball County Discovery Completed

Tom Palmer, Inc. has completed 1-E State, NW NW NW 16-16n-53w, Kimball County. The wildcat is a "J" sand discovery, 5 miles northwest of Woten field. A completion potential of 500 bbl. of oil per day, on pump was reported.

MONTANA

Yellowstone County Discovery Tested

The Atlantic Refining Co. has recovered oil on test of Amsden dolomite

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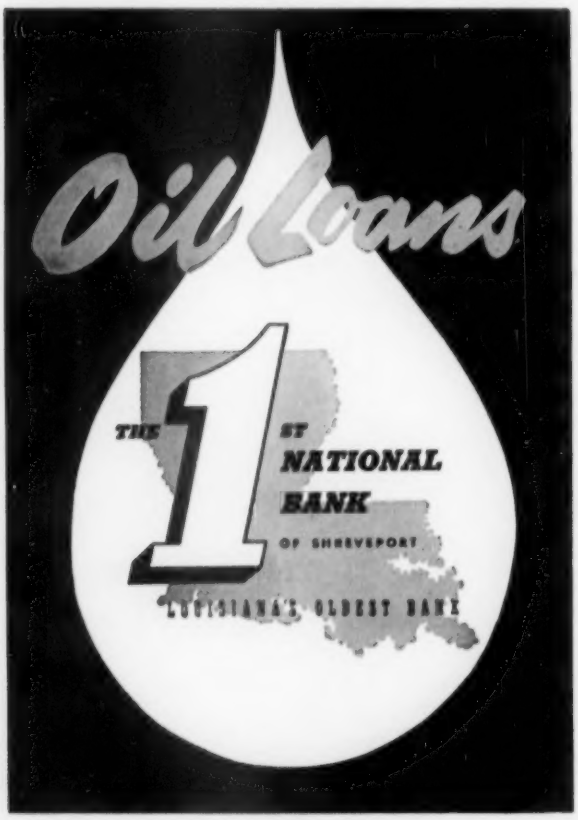
at an important wildcat in northeastern Yellowstone County. The well, 1 Horton estate, C SE SW 18-7n-32e, flowed oil after 15 minutes of a 26-minute drill-stem test. Test was of the interval 6,110-25 ft. There was gas at the surface in 8 minutes. Flowing pressure ranged from 1,760-2,795 psi. There was no estimate of the rate of flow reported. Atlantic attempted to reverse out recovery, but lost circulation. At last the operator was waiting on orders with total depth 6,125 ft. The well was originally scheduled as a 7,500-ft. test of Mission Canyon.

The well is 15 miles southwest of Melstone, and 24 miles south of Amsden production in Northwest Sumatra field. This field has been one of the more active in the state over the past 2 years, and is one of three in the central Montana uplift where Amsden dolomite is productive.

Possible New Pay Zone Seen In Fallon County Wildcat

Shell Oil Co. recovered 3,215 ft. of mud-cut oil on drill-stem test of 22-X-36 State, SE SE NW 3-60n-59e, in the Pennel area of Fallon County. Test was of the zone 7,917-62 ft., with tool open 2½ hours. Flowing pressure at the end of the test was 1,250 psi.

The formation has not been positively identified, but is tentatively picked as lower Mississippipan. If so, the well has apparently established a new pay zone for the Montana portion of the Williston basin. While shows in Bakken and Lodgepole of lower Mississippian age have been found in previous drilling, none were of commercial caliber. The entire U. S. portion of the basin has no production from formations of this age with the exception of that of the stray Sanish sand, in Sanish



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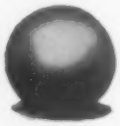

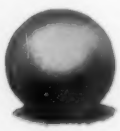

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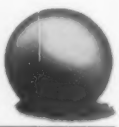

field, North Dakota. Shell originally scheduled the well as a test of Red River (Ordovician) and will continue to that formation before completion. The Fallon County well is just north of the town of Baker, on the Cedar Creek anticline. It is 9 miles southeast of Cabin Creek and 21 miles northwest of Little Beaver. It was previously reported an apparent discovery on the strength of a recovery of 925 ft. of oil on test of Mission Canyon at 7,194-7,250 ft.

COLORADO

Morgan County Wildcat Is Apparent Discovery

Superior Oil Co. recovered 3,360 ft. of oil, 160 ft. of heavily gas-cut mud and 20 ft. of fresh water on drill-stem test at 84-20 Tomky, SE SE NE 20-2n-55w, Morgan County. Test was of the interval 4,928-46 ft. Tool was open 1 hour, with a final flowing pressure of 610 psi. The well is 4 miles east of production in Gary field and 2 miles southwest of Pinneo pool. It is east

A Weld County wildcat recovered 2,900 ft. of clean green oil on a drill-stem test in the Permian-Lyons sand. The California Co. I Priddy, just north of Pierce, Colorado, if successfully completed, will become the second Permian producing area in the Denver-Julesburg basin.

of the area of very intense drilled which followed the discovery at Adena field, largest producer in the Denver-Julesburg basin. Superior is running pipe at the apparent discovery.

WESTERN CANADA

ALBERTA

Wildcat at North End of Pembina Reports Show

The team of Canada Cities Service Petroleum Corp., Seaboard Oil Co. and associates, and Stanolind Oil & Gas

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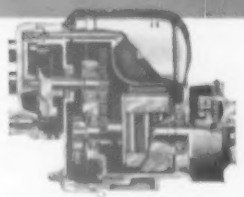

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D. K. "Dewey" Davis, Drilling Superintendent

Co. obtained an encouraging show of oil during a Cardium sand drill-stem test at its Easyford 6-5 stepout test at the north end of Pembina oilfield.

This well, Cities Service et al 6-5 Easyford, LSD 6, 5-50-8w5, which is being operated by Cities Service is situated 1¾ miles north of the Socony-Seaboard team's North Pembina 30-15 Cardium sand oil discovery.

The Cardium sand was tested over a 55-ft. interval, bottomed at 4,848 ft. There was no gas flow recorded but when pipe was pulled it was found to contain 137 ft. of oil and gas-cut mud and 90 ft. of heavily oil and gas-cut mud. The well will be deepened a few feet and crew will run logs in an attempt to evaluate the show.

Oil Swabbed at South Joffre Indicated Strike

The Seaboard group swabbed oil at the rate of 398 bbl .per day at its South Joffre indicated discovery. This central Alberta wildcat, about 10 miles east of Red Deer, had been taken down to test the Devonian reef, but found only a small noncommercial showing of oil along with formation water in that lower horizon.

This strike, Seaboard-Canadian Superior 7-7 South Joffre, LSD 7, 7-38-25w4, found about 3-5 ft. of oil pay in the Viking sand. After perforating a 10-ft. interval, a Sandfrac treatment was applied, and during a 12-hour swab test the well gave up 199 bbl. of formation oil.

Canada Cities Service Petroleum Corp.-Seaboard-Stanolind have found oil shows from the Cardium on a drill-stem test at the 6-5 Easyford extension well 1¾ miles north of Socony-Seaboard's Cardium oil strike at 30-15 North Pembina. The indicated new strike is at the north end of the vast Pembina producing area.

SASKATCHEWAN

Formation Water Entered At South Ralph Area Test

Socony-Mobil Oil Co.-Central Leduc Oils, Ltd., and Del Rio Producers, Ltd., have entered formation water after coring and testing about 30 ft. of limestone zone at their joint well in the South Ralph area.

The well, Socony et al 28-2 South Ralph, LSD 2, 28-6-13w2, ran four drill-stem tests in the Charles-Mission Canyon sectors of the Mississippian. The tests covered 30 ft. above the 4,523-ft. level. Best was 305 ft. of clean gassy oil, with the last test, bottomed at 4,523 ft. giving up 30 ft. of salt water. Crew has resumed drilling at the well.

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Successful Wildcats

SOUTHWEST TEXAS
District 4

Duval County: Monterey Oil Co. 1 W. R. Peters, T. A. Caritt Sur. 34, A-1704. IP 38,000 M.c.f. of gas per day, open flow, plus 8.4 bbl. of dist. per MM., perfs. 8,712-42 ft., 51.2°. TD 10,000 ft. (Gas-distillate discovery).

San Patricio County: Jake L. Hamon 1 Nellie I. Fisher "B," OWDD. Toribio Molina Grant A-18. IP 22,000 M.c.f. of gas per day, open flow, plus 27 bbl. dist. per MM., perfs 7,115-17 and 7,118½-20½ ft., 60.2°. TD 7,512 ft. (Gas-distillate discovery).

Starr County: Sarco Creek Oil & Gas Corp. 1 Martinez, Share 12-B Porcions 70, 71, 72. IP 18,200 M.c.f. of gas per day, open flow, plus 30 bbl. dist. per MM., perfs.

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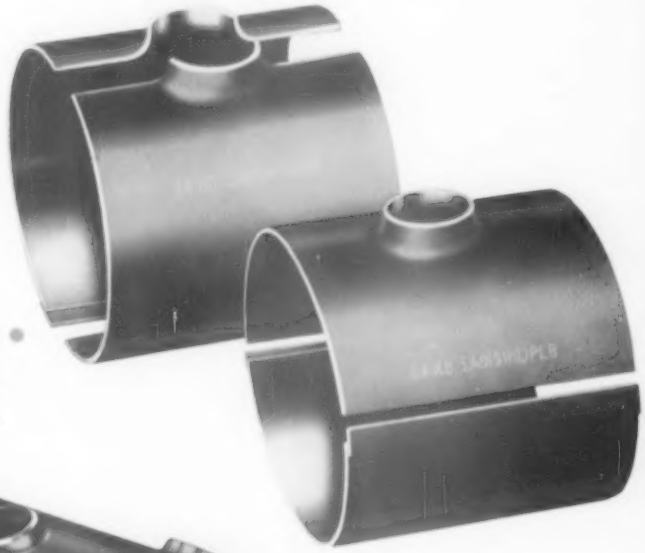

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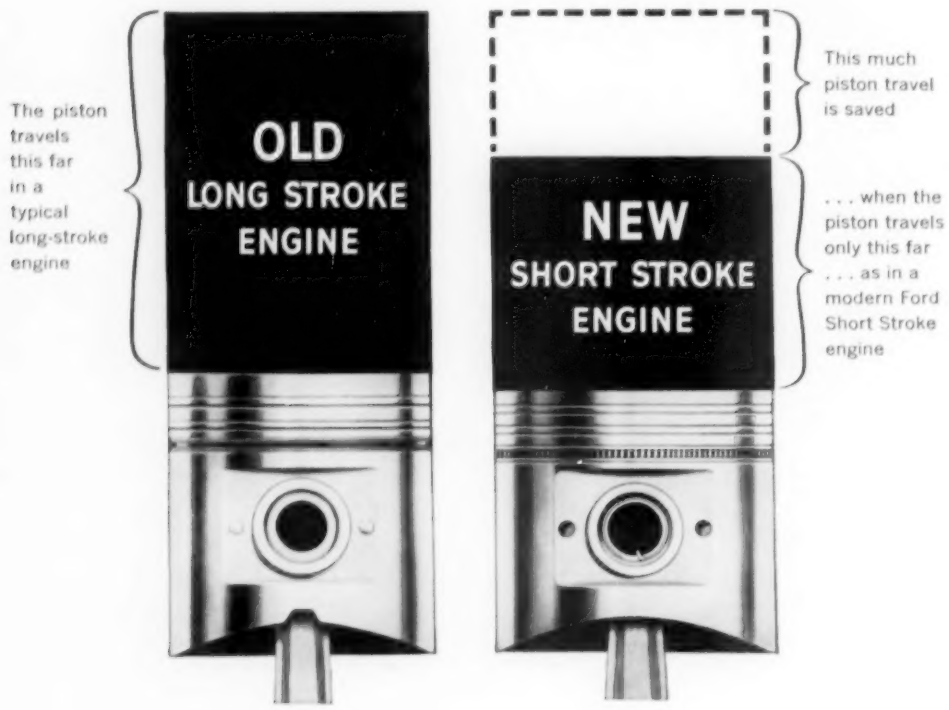
The piston travels this far in a typical long-stroke engine
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LONG STROKE
ENGINE
This much piston travel is saved
. . . when the piston travels only this far . . . as in a modern Ford Short Stroke engine
NEW
SHORT STROKE
ENGINE

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Ford Triple Economy Trucks

THE MONEY MAKERS FOR '55

5,518-48 ft., 52°. TD 5,575 ft. (Gas-distillate discovery).

EAST TEXAS

Shelby County: Dekalb Agricultural Associates, Inc., 2 Pickering Lumber Co., W. J. Crane Sur., 10 mi. E Shelbyville. IPP 38 BOPD, 37°, GOR 645, Blossom sand 2,575-80 ft. TD 2,625 ft.

WEST CENTRAL TEXAS

Callahan County: N. M. Dillard 3 McGraw estate, R. Henderson Sur. 852, 3 mi. NW Cross Plains. IP 29 BOPD, 6/24-in., TP 440 psi., sand 1,612-16 ft. TD 1,660 ft.

Haskell County: Miami Operating Co. 1-A Newcomb, 12-3-H&TC, 14 mi. E Stamford. IPP 60 BOPD, 39°, GOR 207, Swastika sand 1,843-48 ft. TD 4,170 ft.

Nolan County: Union Oil Co. of California 1 Daniels, 93-23-T&P Sur., 6 mi. S Roscoe. IP 77 BOPD, 20/64-in., TP 25 psi., GOR 470, 43.5°, pay 7,050 ft., top Ellenburger 7,085 ft. TD 7,303 ft., elev. 2,515 ft.

Stonewall County: J. R. McLean Oil Co. and J. D. Tompkins 1 Martin, 137-1-H&TC, 11 mi. SE Aspermont. IP 422 BOPD, 12/64-in., TP 575 psi., GOR 345, 42°, pay 5,400-12 ft. TD 6,224 ft.

Taylor County: Ultra Oil Co. and G. B. Stephens 1 Gamble, 7-18-T&P, 4 mi. SW Merkel. IPP 176.79 BOPD, 42°, GOR 327, Flippen limestone 2,758-64 ft. TD 2,830 ft.

TEXAS PANHANDLE

Hansford County: Coats Drilling Co. 1 Miller Est., Blk. 2, Sec. 5, PSL Sur. IPF 32,000 M.c.f. of gas per day, 9 BD per million. TD 7,490 ft. (Gas-distillate discovery).

NORTH TEXAS

Archer County: Bailey & Lofton 1 Abercrombie, Blk. 70, J. W. Harris Subd., 5 mi. W Archer City. IPP 53 BOPD, 36°, GOR zero, pay 1,128 ft. TD 1,137 ft.

L. T. Burns 1-A Smith, TE&L Sur. 1860, A-541, 7½ mi. SE Anarene. IP 174 BOPD, 30/64-in., TP 360 psi., 43°, GOR 640, Mississippian 5,062-72 ft. TD 5,293 ft.

Clay County: Cities Service Oil Co. 1 Scheer, T. Tanner Sur., A-695, 1 mi. NE Henrietta. IP 180.36 bbl. in 9 hr., 24/64-in., TP 950 psi., GOR 830, 42.8°, conglomerate 6,190 ft. TD 6,196 ft.

Grayson County: Larson & Thomas 1 McCullough, Wm. High Sur., A-516, 5 mi. NW Sherman. IP 176 BOPD, 18/64-in., 66°, TP 1,925 psi., GOR 13,378:1, pay 9,357-97 ft. TD 9,451 ft.

J. C. Maxwell 1 Green, Gideon Rose Sur., A-993, 5½ mi. NE Callisburg. IP 259 BOPD, 13/64-in., 37°, TP 330 psi., GOR 456, Strawn pay 6,325 ft. TD 6,333 ft.

Montague County: Lion Oil Co. 1 Stephens-Caswell, Blk. 39, Titus CSL Sur., 5 mi. NE Sunset. IPP 20.23 BOPD, 41°, GOR 650, Caddo 6,113-35 ft. TD 6,311 ft.

Young County: A. B. Edwards 1 Lennington, A. J. Ernest Sur., A-92, 4 mi. S Graham, 1¼ mi. SE production. IP 117 BOPD, 24/64-in., 39°, TP 125 psi. GOR 450, conglomerate 4,044-48 ft. TD 4,100 ft.

NORTHWEST NEW MEXICO

Rio Arriba County: Southern Union Gas Co. 2-K Jicarilla, SE NW NE 11-25n-5w. IP 10,000 M.c.f. of gas per day, Pictured Cliffs sand gas discovery, new field. TD 3,071 ft. Pictured Cliffs.

WEST TEXAS

Andrews County: B. L. McFarland Drilling Co. 1 Bird, 8-A19-PSL Sur., 10 mi. NE Andrews. IPP 93 BOPD, 32.6°, GOR 282, Queen sand, pay 4,790 ft. TD 5,700 ft.

Crockett County: Cities Service Oil Co. 1-E Noelke, 32-GG-GC&SF, 9 mi. NE Sheffield. IP 198 BOPD, 14/64-in., TP 550 psi., GOR 675, 37°, Cisco limestone 5,580-85 ft. TD 5,591 ft.

Gaines County: The Texas Co. 1 Pence, Tract 2, Lge. 3.3, Gaines CSL Sur., 12 mi. SE Seminole. IPP 68.47 BOPD, 25°, GOR 76, top Wolfcamp pay 9,416 ft. TD 11,255 ft., PB 9,470 ft.

Runnels County: G. W. Heinzelmann 1-A Brookshire, A. P. Thompson Sur. 4, A-633, 10 mi. NE Ballinger. IPP 96 BOPD, 47°, Serratt sand 2,210 ft. TD 2,214 ft.

Winkler County: Stanolind Oil & Gas Co. 20 Sealy & Smith Foundation "A," Devonian discovery in North Monahans field. IP 350.6 BOPD, 11/64-in., TP 1,375 psi., GOR 1,527, 38.4°, perforations 9,460-9,600 ft., top pay 9,447 ft. TD 13,200 ft., elev. 2,779 ft.

INDIANA

Pike County: C. Burton 1 Taylor-Lemond, NW NE NE 17-2s-6w. IPP 10 BOPD, McClosky 1,115-19 ft. TD 1,119 ft. (Oil discovery).

KENTUCKY

Butler County: Cox Drilling Co. et al 1 Barbee, NE SW NE 18-I-32. IPP 18 BOPD, Tar Springs 902-18 ft. TD 923 ft. Opens Hanks pool).

OHIO

Coshocton County: National Gas & Oil Corp. 1 J. G. Lawrence, Sec. 10, Bethlehem Township. IP 1,500 M.c.f. daily, Clinton 3,631-3,700 ft. TD 3,800 ft.

Holmes County: Diamond Oil & Gas Co. 1 Donald Doty, Sec. 17, Knox Township. IP 2,400 M.c.f. daily, Clinton 2,963-82 ft., TD 2,983 ft.

SOUTH LOUISIANA

Jefferson Parish: Tide Water Associated Oil Co. 3 St. Lease 1299, 35-18s-24e. IPF 213 BOPD, ⅛-in. choke, GOR 2080:1, 30.5°, perfs. 12,374-88 ft. TD 14,758 ft. (Oil sand discovery in Manila Village field).

Plaquemines Parish: Kerr-McGee Oil Industries, Inc. 1-F St. Lse. 1999. Offshore, Breton Sound Block 20 area. IPF 240 BOPD, 10/64-in. choke, 26.2°, GOR 600:1, perfs. 5,846-57 ft. TD 6,200 ft.

Terrebonne Parish: Humble 1-A St. Lse. 1033. Offshore, South Timbalier area. IPF 420.88 BOPD, 204,300 cu. ft. of gas per day, ⅛-in. choke, GOR 485:1, 38.3°, perfs. 6,591-6,605 ft. TD 11,831 ft. (Oil discovery).

KANSAS

Stafford County: Arnold Kimmis-World Uranium 1 Long, NE NE SW 36-22s-13w. IPP 237 BOPD, Lansing-Kansas City 3,576-82 ft., 32°. TD 3,813 ft. (Oil discovery).

Sumner County: Aladdin Petroleum Corp. 1 Voils, NE NE NE 27-31s-1w. IPP 258 BOPD, Miss. 3,649-64 ft., 45°. TD 3,717 ft. (Opens Northeast Wellington pool).

OKLAHOMA

Marshall County: Sinclair Oil & Gas Co. 1 Taliaferro, SE SE SW 14-5s-5e. IPF 325 BOPD, second Bromide sand 6,240-6,312 ft., ½-in. choke, 36.1°. TD 6,882 ft. (Geological wildcat and new-pay discovery at North Madill field).

CALIFORNIA

Kern County: Shell Oil Co. 1 Posuncula, NE NE 12-30s-25e. IPF 1,084 BOPD, 33.5° gravity, 20/64-in. choke, 830 M.c.f. gas, perfs. 12,360-12,410 ft., TD 14,224 ft. (Deeper pool discovery, in Vedder sand of Lower Miocene age, in Strand field.)

NEBRASKA

Kimball County: Tom Palmer, Inc. 1-E State, NW NW NW 16-16n-53w. IPP 500 BOPD, 40° gravity, "J" sand discovery, new field. TD 5,758 ft. Skull Creek.

MONTANA

Dawson County, Gas City Unit: Shell Oil Co. 33X-21, NE NW SE 21-14n-55e. IPF 202 BOPD, Red River discovery, new field. TD 9,596 ft. Winnipeg.

WYOMING

Big Horn County, Northwest Byron: Phillips Petroleum Co. 1 State-Lodestone, SW SW NW Tract 37, 17-56n-97w. IPF 77 BOPD, Tensleep discovery, new pay. TD 6,348 ft. Tensleep.

UTAH

San Juan County, North Boundary Butte: Shell Oil Co. 1 North Boundary Butte, C SW NE 33-42n-22e. IPF 375 and 117 BOPD, Paradox discovery, new field. TD 5,975 ft. Ouray.

COLORADO

Washington County: Dawson & Cramer 1 Morgan, C SE SE 30-1s-55w. IPP 134 BOPD, "D" sand discovery, new field. TD 4,875 ft. "D" sand base.

ALBERTA

Western 34-11 Hairy Hill, LSD 11, 34-55-14w4. Colony gas well. TD 1,867 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 280 acres of land in four separate parcels within the known geologic structures of the Mush Creek and Southeast Skull Creek Fields, Weston County, Wyoming, are offered for oil and gas leasing through sealed bids to the qualified bidder of the highest amount per acre at 2:00 P.M., MST, July 21, 1955, when bids will be opened. Details of the lease offering and how and where to submit bids may be obtained from the Land Office at Cheyenne, Wyoming. Perry T. Williams, Manager.

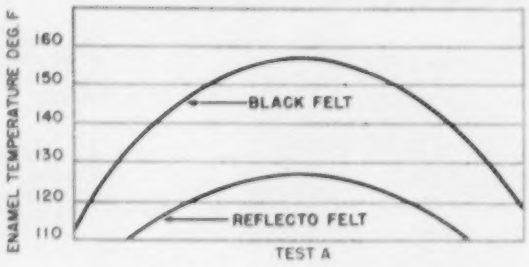
LEGAL

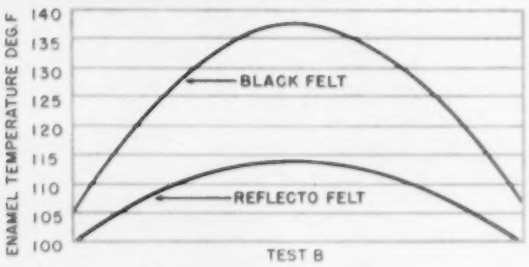
U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 2838.04 acres of land in fifteen parcels, within the known geologic structure of Williams Park Anticline, Routt County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T. June 30, 1955, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington, D. C. By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 and Public Land Order No. 1062 of February 3, 1955, notice is hereby given that 5 parcels of land, containing 1603.20 acres situated within the Camp Wallace Military Reservation in Galveston County, Texas, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 p.m., E.D.T., on July 6, 1955 when bids will be opened. Details of the lease offer, description of the lands with a plat showing the approximate location thereof, how and where to submit bids, and bid forms may be obtained from the Oil & Gas Supervisors of the Geological Survey at 239 Federal Building, Tulsa, Oklahoma, and 333 St. Charles Avenue, New Orleans 12, Louisiana, or from the Washington office of the Bureau of Land Management or the Land Office at Santa Fe, New Mexico. L. E. Hoffman, Minerals Staff Officer.

REDUCE TEMPERATURE
of ENAMEL as much as 30°
WITH NICOLET REFLECTO-FELT





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Under controlled surface heat of 140 degrees, enamel under black felt registered 156 degrees. The enamel under Reflecto-Felt registered 126 degrees . . . A TEMPERATURE REDUCTION of 30 DEGREES.

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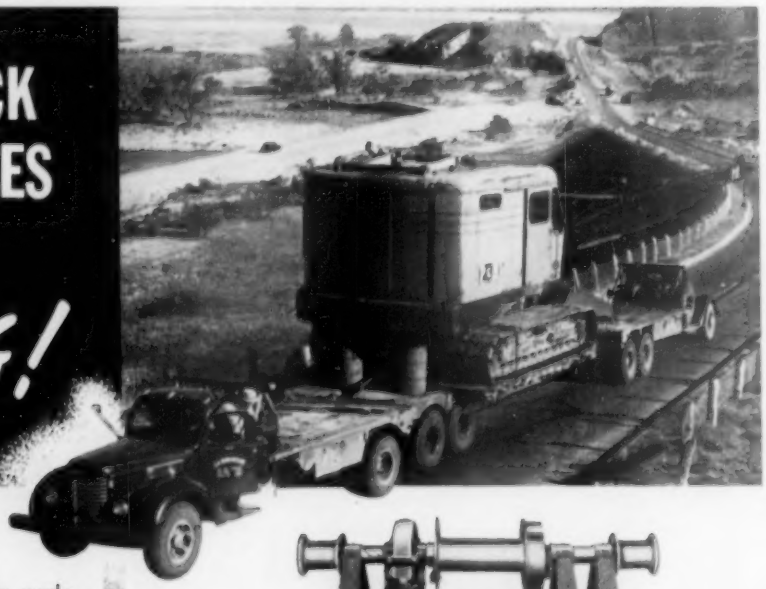
WITH REFLECTO-FELT, YARD WRAPPED PIPE CAN NOW BE STORED. ENAMEL SAG IS REDUCED ON PIPE COATED OVER THE DITCH. INVESTIGATE REFLECTO-FELT NOW. WRITE FOR LITERATURE.

The Felt With a Future

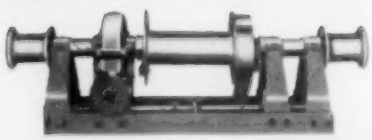
MANUFACTURED BY:
NICOLET INDUSTRIES, INC.

70 PINE STREET
NEW YORK 5, N. Y.

TULSA* TRUCK POWER WINCHES *for* HAULING!



Movement of this power shovel was made easily and quickly by a Texas trucking contractor with two truck-mounted Tulsa Winches. This is just another example of the versatility and reliability of Tulsa Winch. There is a Tulsa Winch for every make and model of truck and crawler tractor.



Tulsa* Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

PERSONALS

Confirmed Engineer

He'd take it up again if starting over, Weil says

PUT a bunch of rocks in a jug. Shake it. And the big ones will come to the top.

That's how Albert H. Weil explains why good engineers nearly always rise to the top.

Weil, general superintendent of gasoline plants department for United Gas Pipe Line Co., Shreveport, La., adds there'll be plenty of room in the jug for good engineers in the future. He describes it as a growth profession of the first order.

Weil, an engineer for 29 years with nearly 26 of them spent with United Gas, believes America's tremendous growth in industry, transportation, housing, air conditioning, and other fields is ever increasing the demand for engineering talent. He expects this situation to prevail for at least 25 to 30 years.

Builder at heart . . . Weil was attracted to engineering because he wanted to build things. Through the years in one way or another he's kept his hand in that phase of the business. He added he would study engineering again if he was starting over, but would add law courses to give his education a broader base.

The 49-year-old Weil is a native of Shreveport. He was graduated from high school there in 1922 and from Virginia Military Institute in 1926 with a civil-engineering degree. He worked with American Bridge & Iron Works in Philadelphia and the Baltimore & Ohio Railroad in Indiana before taking post-graduate work for a master's degree at Purdue.

Atomic plant . . . Weil returned to Shreveport in 1929 for an engineering job with the Palmer Corp., one of the predecessor companies of United Gas Corp. He has remained with the organization ever since. He spent more than a year in designing and building gasoline plants, compressor stations, and pipelines. In 1930 he went to Houston as assistant engineer, and 3 years later was assigned as an industrial engineer to the sales department. With headquarters at Jackson, Miss., he handled sale and utilization of natural gas in United Gas divisions in Mississippi, Alabama, and Louisiana.

When United Gas launched its Gulf South program to attract industries to that region, Weil was promoted to the industrial development department to help the campaign. He was transferred the next year to Shreveport when United relocated its general offices there.

Soon afterwards, Weil was called to military service as a reserve officer. He spent 5 years in military construction, including more than 2 years with Manhattan Engineering District, Oak Ridge, Tenn.

Following the war, Weil returned to United Gas as general superintendent of gasoline plants just in time to participate in the firm's expanded building program. Right now, he says, the company is "in between projects" with none going but several on the planning boards.

Life isn't all work for Weil. He enjoys family and outdoor activities. He was married in 1930 to Miss Frances Calder of Virginia and Kentucky. Their 16-year-old daughter, Susan, is a high school junior. Weil likes golf, fishing, and hunting. He is a member of the Shreveport Club, Shreveport Country Club, Round Table Club, American Petroleum Institute, Natural Gasoline Association of America, and American Gas Association.

Jed B. Maebius, assistant exploration manager of the Tulsa production division of Gulf Oil Corp., has resigned to enter private consulting work with headquarters in Tulsa. Maebius joined Gulf in 1935 at Saginaw, Mich. In 1945 he was moved to Tulsa as staff geologist and in 1951 was made area manager of exploration at Casper, Wyo. He returned to Tulsa in 1952 as chief exploration geologist and in 1954 was promoted to chief geologist for the Tulsa production division.

Wiley W. Wiggins of Atlantic Refining Co., Tyler, Tex., was elected president of the National Oil Scouts and Landman's Association at its annual convention in Banff, Alta. Wiggins succeeded **J. S. Lock,** Midland, Tex.

Robert J. Meers has joined Cyprus Oil Co., Division of Cyprus Mines Corp. at Houston as superintendent of production. Meers has been serving as chief engineer for Loffland Brothers Drilling Co., Tulsa. Before joining Loffland, he was superintendent of production for Union Oil Co. at Houston.

Ray Powell has been named assistant to the senior vice president of The Texas Co. Since joining Texaco in 1931, Powell has served in the company's Bayonne, N. J., and Providence, R. I., terminals; Port Arthur, Tex., and Lawrenceville, Ill., refineries; and the New York City headquarters of Texaco's refining department. He has been supervisor of process engineering in the company's refining department since 1944.

C. F. Whaley of Whaley Well Servicing Co., Houston, last week was elected president of the American Association of Oilwell Drilling Contractors at a meeting of the organization's directors in Denver. He succeeds Joseph V. Dunbar, of Denver, who died June 5.

A. R. Goldsby has been named director of research of Stratford Engineering Corp. Goldsby had been employed by The Texas Co. and Texaco Development Corp. since 1936. Stratford Engineering is active in the petroleum and chemical fields and recently has been named agent for the sulfuric acid alkylation process.

Roy B. Kelly, Washington, D. C., attorney, has succeeded **Curtis F. Bryan** as president of Toklan Oil Corp. Kelly heads a group of investors who recently bought the interests of Bryan, Tulsa oil man and banker. **Vaughn Bryan,** an officer of the company with the previous management, and **James L. Ballard** have been appointed vice presidents. The new board of directors includes **Holman Jenkins,** Dallas attorney; **Wallace M. Davis, Jr.,** Investment Management Corp., Dallas; **A. F. Childers, Jr.,** Houston; and **Ricard R. Ohrstrom,** New York City investment

PERSONALS

banker, in addition to Kelly and Ballard. **Cecil V. Hagen,** Houston geologist, and oil operator, has been named consultant for the firm.

Eger V. Murphree, president of Esso Research & Engineering Co., last week was reelected chairman of the permanent council of the World Petroleum Congress meeting in Rome. Murphree was first elected to the post at the Congress held at The Hague.

Fred W. Kumpf, production engineer with Mobil Producing Co. in Wyoming's Big Horn basin the past 5 years, has been promoted to senior production foreman at Casper, Wyo. **Turner C. Smith** has been named to succeed Kumpf in the Big Horn basin.

DR. K. A. WEST

Dr. Kenneth A. West has been appointed manager of manufacturing for Canadian Oil Companies, Ltd., and has also joined the company's management committee. Formerly production superintendent at the company's Sarnia refinery and assistant manager of manufacturing, West succeeds **Earl A. Smith,** who recently retired.

George H. Neilson has been elected a vice president of Algonquin Gas Transmission Co., Boston. He had been serving as chief engineer of the company before his promotion.

Henry C. Calhoun has been elected vice president in charge of the land department of Southern Production Co., Inc. Calhoun has been associated with Southern Production since 1947. He previously was with Carter Oil Co. several years.

Herbert Rothstein has been named vice president of Bell Oil & Gas Co., Tulsa. Formerly the secretary of the company and assistant vice president, Rothstein will be succeeded in the secretarial post by the present company auditor, **Joel P. Dyer. E. S. Horner,** superintendent of the Ardmore plant of Bell's subsidiary, Ben Franklin Refining Co., has been advanced to manager of refining for Bell. **L. K. Buchanan** has been named associate superintendent at Ardmore and **Russell Davidson,** chemical engineer. In Tulsa, **Robert J. Newman,** engineer, has been named executive assistant in the refining section.

Stanley T. Crossland, vice president and treasurer of The Texas Co., and **Harry H. Arnold, Jr.,** formerly managing director N. V. Caltex Pacific Petroleum, Mij., Indonesia, have been elected to the board of directors of California Texas Oil Co., Ltd. Crossland was formerly vice president, treasurer, and director of Ethyl Corp. Arnold, a vice president of Caltex, has been reassigned to New York in charge of the producing division.

S. T. CROSSLAND

H. H. ARNOLD, JR.

Percy W. Thirtle, vice president of Sinclair Oil Corp., has retired after 39 years with Sinclair companies. He was one of the group which organized Sinclair Oil & Refining Corp., a predecessor of Sinclair Oil Corp.

John P. Viglini, formerly senior engineer in Lone Star Gas Co.'s transmission division, has been promoted to assistant chief engineer of the division.

Dr. W. C. Gussow and **Dr. J. C. Sproule,** consulting geologists of Calgary, have been admitted to membership in the Royal Society of Canada. They were among 24 Canadians approved for membership at the annual meeting of the society in Toronto.

Ben R. Newbery, director of purchases and materials for Lone Star Gas Co. at Dallas, has received the 1955 Shipman Award from the National Association of Purchasing Agents for outstanding services to the purchasing field. Newbery joined Lone Star in 1919 and has been director of purchases and materials since 1943.

DEATHS

Dr. I. Arthur Anson, 67, vice president in charge of manufacturing, Bell Oil & Gas Co., and president of Ben Franklin Refining Co., died June 10 in Tulsa after a long illness. Anson helped to form the old Altitude Petroleum Corp., of which he was president, and became a vice president of Bell Oil & Gas in 1934 when Bell absorbed the Altitude corporation.

Paul E. Crane, 49, buyer of mechanical equipment for the purchasing department of Sun Oil Co., died recently at his home in Lafayette Hill, Pa. Crane joined Sun Oil as a pipeline engineer in 1934 and transferred to the purchasing department in 1937.

Dan Danciger, 86, former president of Danciger Oil & Refining Co., died June 15 in Fort Worth after an extended illness. Danciger founded the company at Kansas City and was president from 1917 to 1950 when it was sold to the Southern Production Co., Shreveport.

Chestien Wynn, 84, founder of Wynn Oil Co., died of a heart ailment recently in Pasadena, Calif. He had retired as president of his company in 1950.

Earl J. Robishaw, 44, vice president of A-1 Bit & Tool Co., died recently in Houston. He was at one time employed by The Texas Co. and had been with A-1 for 18 years.

John G. Norton, a director and chief engineer of Magnolia Pipe Line Co., died June 14 in Dallas after prolonged illness. Joining Magnolia Pipe Line in 1927 as assistant superintendent of maintenance, Norton was advanced to chief mechanical engineer in 1938 and became a director of the company 2 years ago.

Coleman K. Cassady, 62, assistant superintendent of the pipeline department of Sinclair Pipe Line Co., died June 14 in Pryor, Okla., after suffering a stroke. He had been employed by the Producers & Refiners Pipe Line Co. and its successor, the Sinclair firm, since 1922.

Harold Lee Corbett, 59, president of Corbett Drilling Co., died of a heat attack June 10 in Tulsa. Corbett was a partner in Corbett-Barbour Drilling Co. from 1919 until 1948, when he organized the Corbett Drilling firm.

J. P. Pool, 55, independent oil and gas operator in Texas, died after a heart attack recently at Victoria.

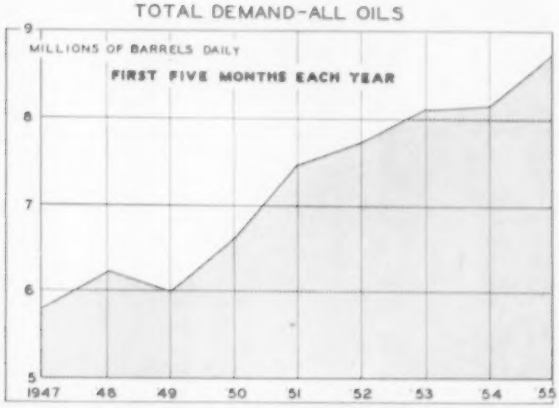
Willie McKinley Wright, 58, production superintendent for Producers Oil Co. in Bakersfield, Calif., died there recently.

Latest Figures . . . Industry Trends

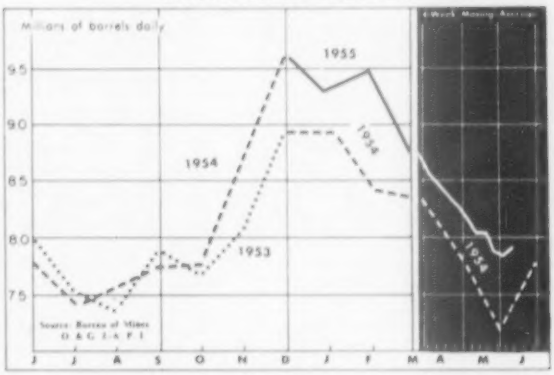
A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,594,475	DOWN	6,750	UP	72,630
Crude stocks	278,236,000	DOWN	3,676,000	DOWN	313,000
Completions	1,009	DOWN	70	DOWN	100
Refinery runs	7,522,000	DOWN	43,000	UP	702,000
Gasoline stocks	166,233,000	DOWN	2,752,000	DOWN	5,137,000
Distillate stocks	88,414,000	UP	4,069,000	UP	10,919,000
Residual stocks	45,194,000	UP	835,000	DOWN	3,336,000
Four-product stocks	326,873,000	UP	2,840,000	UP	4,671,000
Total imports	1,077,500	UP	2,700	UP	278,300

TOTAL DEMAND-ALL OILS



TOTAL DEMAND-ALL OILS



Current Demands are High Only When Compared with Low Levels of 1954

TOTAL demand for all petroleum products in the first 5 months of this year was about what would be expected from the postwar trend. However, the percentage increase over the same period last year was abnormally high.

A limited comparison of 1955 demand with demand for the same period in 1954 gives a false picture, since a big part of the increase can be charged to the low level of demand in 1954 rather than to unusual product demand so far this year.

Total demand for the first 5 months of each year since the end of the war is shown on the above chart. Note that there were two bad years in the period. Demand for the first 5 months of 1949 represented a decrease of 2.8 per cent from demand for the same period in 1948. Also, demand in 1954 was up only 0.3 per cent over 1953.

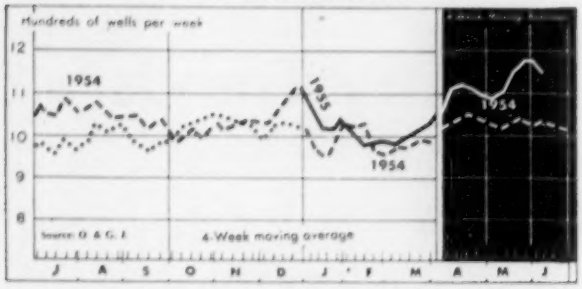
Each of these slack years was followed by sharp recovery gains. Demand for 1950 was up 9.9 per cent, and the gain this year was 7.5 per cent. The average annual gain for the 1947-53 period was 5.8 per cent. For the 1953-55 period the gain averaged only 3.8 per cent a year. This indicates that the good percentage gain this year may not have been large enough to offset the poor showing in 1954.

Since the percentage gain for the four major products fell short of the increase for all oils, minor products take some of the credit for the general improvement by petroleum. Compared with the over-all gain of 7.5 per cent, gasoline was up 6.7 per cent, middle distillate up 5.7 per cent, and residual up 7.9 per cent. The four-product gain was 6.6 per cent.

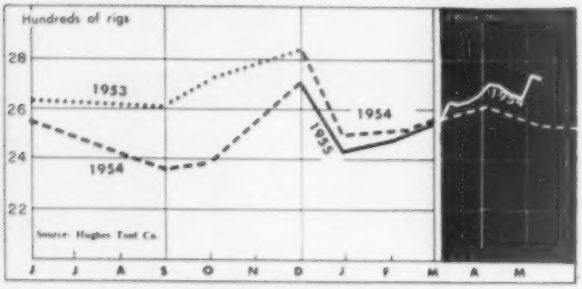
The good gain of 7.9 per cent for residual was due to low demand in 1954, not to abnormal demands this year. Residual demand for the first 5 months was up only 0.5 per cent over the average for the same period in 1953.

This year's demand data for minor products are available only for the first 3 months. Some of the gains were: L.P.G., 20.6 per cent; asphalt and road oil, 12.2 per cent; jet fuel, 33.9 per cent; and coke, 31.1 per cent. Minor products and crude represented 13.9 per cent of demand in the first quarter but accounted for 26.5 per cent of the gain over the first quarter of 1954.

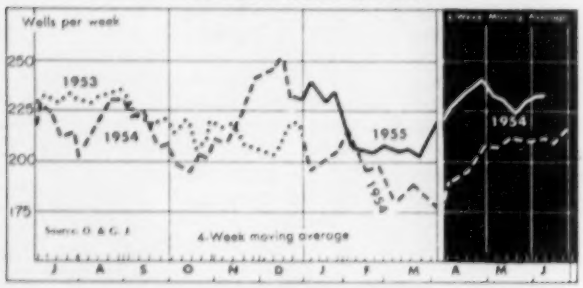
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	6-13-55	Change from 6-6-55	Change from 6-14-54
Gulf Coast	594	—8	43
N. and W. Texas-New Mexico	892	6	102
Arkansas-N. Louisiana-E. Texas	180	5	10
Oklahoma	347	5	7
Kansas-S. Nebraska	186	10	16
Illinois-Eastern	135	—28	0
Rocky Mountain	255	—1	4
Pacific Coast	150	0	19
Total United States	2,739	—11	201
Western Canada	167	9	54

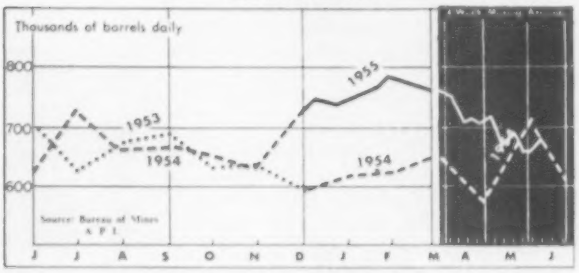
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 11, 1955

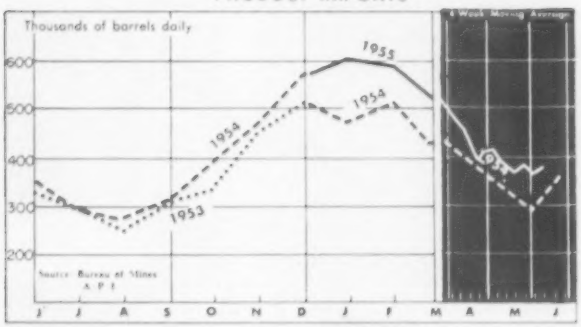
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	1	0	0	1	3,520	40	47	0	0	0	1	1	0	0	0	38	38
Arkansas	8	7	0	1	26,153	318	254	0	0	0	1	1	16	0	1	78	95
California	52	36	1	15	278,725	1,152	1,112	1	0	0	9	10	19	0	5	179	203
Colorado	29	7	0	22	154,096	602	574	1	0	0	19	20	22	0	14	304	340
Illinois	42	20	0	22	100,049	1,551	1,215	0	0	0	8	8	27	0	1	238	266
Indiana	9	3	0	6	14,464	331	363	1	0	0	4	5	8	0	0	152	160
Kansas	91	37	6	48	330,345	2,258	1,934	2	0	0	24	26	61	1	17	355	434
Kentucky	15	8	0	7	19,832	543	494	1	0	0	3	4	19	0	5	85	109
Louisiana	54	40	6	8	321,267	1,764	1,445	3	0	0	4	7	55	38	12	173	278
North	32	25	2	5	103,022	951	768	0	0	0	2	2	9	3	1	69	82
South	22	15	4	3	218,245	813	677	3	0	0	2	5	46	35	11	104	196
Michigan	18	3	1	14	67,249	231	234	0	0	0	10	10	6	0	0	90	96
Mississippi	10	1	0	9	61,550	213	165	0	0	0	5	5	5	0	0	78	83
Montana	9	5	0	4	44,749	143	119	1	0	0	4	5	3	0	1	41	45
Nebraska	16	5	0	11	91,634	308	151	1	0	0	5	6	17	0	0	120	137
New Mexico	37	18	14	5	129,648	649	479	0	0	1	3	4	16	1	5	48	70
Northwest	16	0	13	3	52,385	186	140	0	0	1	2	3	2	0	5	16	23
Southeast	21	18	1	2	77,263	463	339	0	0	0	1	1	14	1	0	32	47
North Dakota	1	0	0	1	9,000	95	106	0	0	0	0	0	0	0	0	15	15
Ohio	26	13	7	6	58,125	484	510	0	0	2	1	3	1	0	4	13	18
Oklahoma	141	84	2	*55	484,037	3,793	4,105	1	0	0	10	11	56	7	16	286	365
Pennsylvania-New York	35	12	7	*16	80,787	746	1,086	0	0	0	2	2	0	0	5	5	10
Texas	386	239	15	132	1,730,490	8,695	8,006	18	3	2	69	92	331	51	60	1,776	2,218
Southwest (1 & 4)	62	33	3	26	281,847	1,369	1,119	0	2	2	12	16	42	15	21	342	420
Gulf Coast (2 & 3)	47	17	8	22	312,728	1,139	1,150	0	0	0	13	13	37	28	21	285	371
East (5 & 6)	10	6	2	2	64,256	418	415	1	0	0	0	1	13	3	2	131	149
North Central (7-B & 9)	146	91	0	55	429,683	3,132	3,053	12	0	0	24	36	170	0	4	683	857
West (7-C & 8)	102	74	1	27	578,004	2,193	1,854	5	0	0	20	25	66	1	6	323	396
Panhandle (10)	19	18	1	0	63,972	444	415	0	1	0	0	1	3	4	6	12	25
Utah	3	1	0	2	12,277	31	28	1	0	0	2	3	3	0	2	18	23
West Virginia	10	0	9	1	27,203	264	231	0	0	0	0	0	0	0	6	10	16
Wyoming	16	12	0	4	84,270	344	608	1	0	0	1	2	9	0	3	69	81
Miscellaneous	0	0	0	0	0	15	77	0	0	0	0	0	0	0	0	12	12
Total United States	1,009	551	68	390	4,129,470	24,570	23,343	32	3	5	185	225	674	98	157	4,183	5,112
Total previous week	1,079	603	73	403	4,269,232			26	3	5	190	224	642	95	152	3,998	4,887
Total June 12, 1954	1,109	649	80	380	4,433,821			27	2	10	160	199	631	66	152	3,846	4,695
Western Canada	44	32	1	11	222,247												

Service wells included: *8.

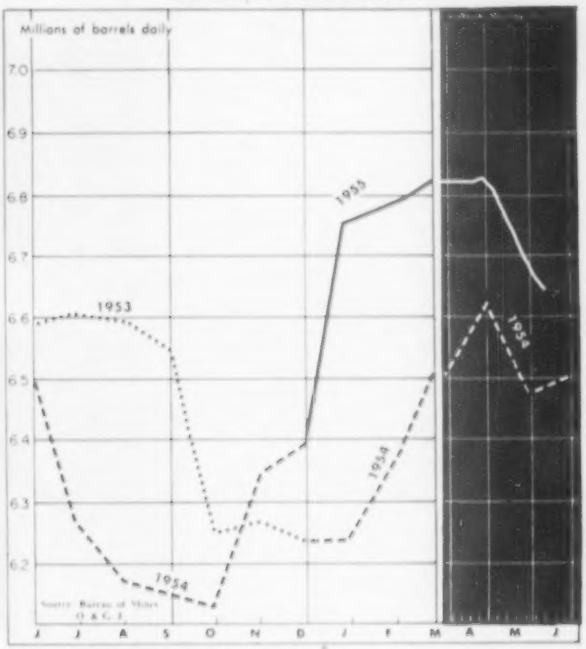
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE OIL PRODUCTION

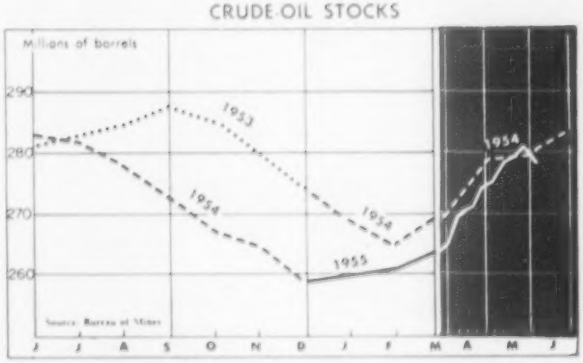


DAILY AVERAGE PRODUCTION FOR WEEK

	June 11 Crude oil	June 11 Lease condensate	June 11 Total	June 4 total
Alabama	3,500		3,500	3,600
Arkansas	72,900	500	73,400	73,800
California	975,200		975,200	975,200
Colorado	138,300		138,300	141,600
Eastern	46,500		46,500	46,500
Florida	1,300		1,300	1,325
Illinois	234,100		234,100	228,500
Indiana	29,400		29,400	28,600
Kansas	308,500		308,500	297,800
Kentucky	40,400		40,400	40,300
Louisiana	640,800	47,900	688,700	698,600
North	112,800	2,900	115,700	115,300
South	528,000	45,000	573,000	583,300
Michigan	32,300		32,300	32,300
Mississippi	94,150	4,150	98,300	97,050
Montana	46,100		46,100	45,500
Nebraska	29,200		29,200	29,400
New Mexico	221,800	3,550	225,350	228,850
North Dakota	20,800		20,800	22,300
Oklahoma	532,600		532,600	524,300
Texas	2,733,200	47,325	2,480,525	2,796,400
Dist. 1	53,000	550	53,550	53,900
Dist. 2	136,700	7,500	144,200	145,925
Dist. 3	421,000	21,500	442,500	445,925
Dist. 4	230,800	5,200	236,000	236,975
Dist. 5	45,500	400	45,900	45,900
Dist. 6	115,800	4,800	120,600	121,850
East Texas field	207,300		207,300	210,550
Dist. 7-B	141,000	50	141,050	139,900
Dist. 7-C	183,000	4,600	187,600	188,975
Dist. 8	906,000	2,100	908,100	911,975
Dist. 9	204,600	500	205,100	206,475
Dist. 10	88,500	125	88,625	88,050
Utah	5,500		5,500	5,800
Wyoming	284,100		284,100	283,200
Others	‡400		‡400	300
Total U.S.	6,491,050	103,425	6,594,475	6,601,225
Change from prev. week, down			6,750	
Canada	†286,927		†286,927	†295,675
Total U.S. production January 1-June 11			1,091,488,075 bbl.	
Same period last year (crude plus cond.)			*1,044,450,390 bbl.	

*Includes 16,687,225 bbl. condensate. †Week ended previous Monday. ‡S.D. 100, Nev. 300.

CRUDE OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

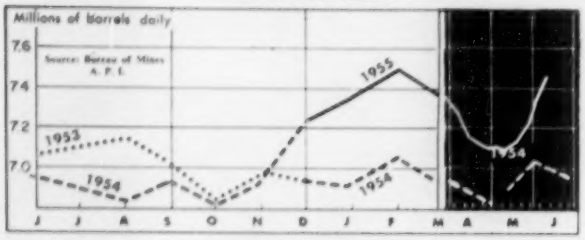
(Thousands of barrels daily)

	June 4, '55	May 28, '55	June 5, '54
Pennsylvania Grade	2,896	2,863	3,187
Other Appalachian	2,030	2,158	1,885
Illinois, Indiana, Michigan	12,156	13,353	12,681
Nebraska, North Dakota	2,405	2,678	(‡)
Kansas	8,467	8,685	9,733
Oklahoma	24,364	25,593	27,222
Arkansas	2,904	3,043	3,255
Louisiana	17,034	16,447	16,345
North	2,671	2,742	2,420
South	14,363	13,705	13,925
Mississippi	2,893	2,927	3,074
New Mexico	8,340	8,822	7,458
Texas	129,232	128,809	129,565
East Texas proper	10,094	9,953	12,211
West Texas	57,212	58,082	55,241
Texas Gulf	26,473	26,410	28,870
Other Texas	35,453	34,364	33,243
Wyoming	15,426	15,906	13,503
Other Rocky Mountain	5,113	5,162	4,239
California	31,317	31,979	32,833
Foreign	†13,659	13,487	13,569
Total	278,236	281,912	278,549

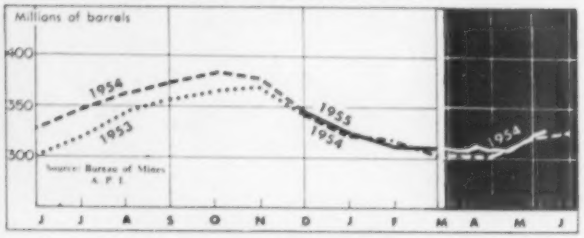
*Bureau of Mines. †Includes 3,062,000 bbl. in California. ‡Included with Kansas.

CURRENT DATA ON RUNS AND PRODUCTION ARE 4-WEEK AVERAGES

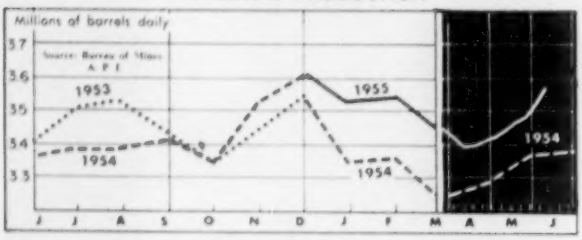
REFINERY RUNS



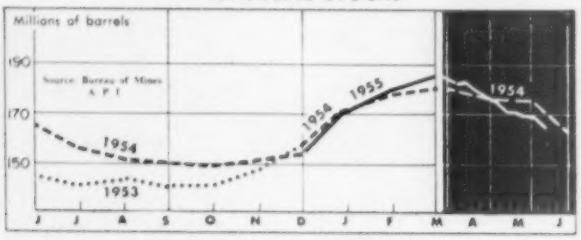
FOUR-PRODUCT STOCKS



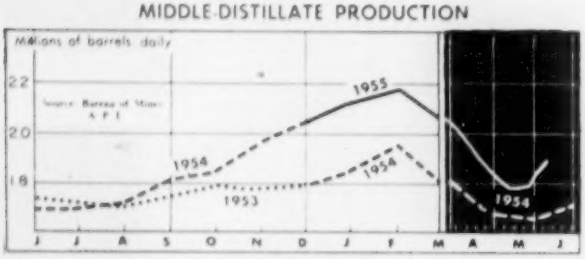
GASOLINE PRODUCTION



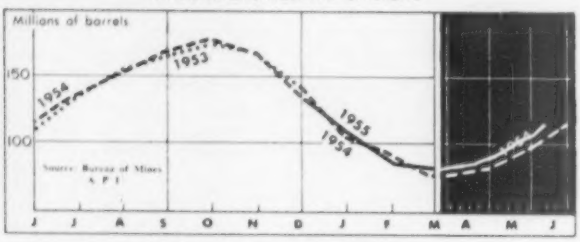
GASOLINE STOCKS



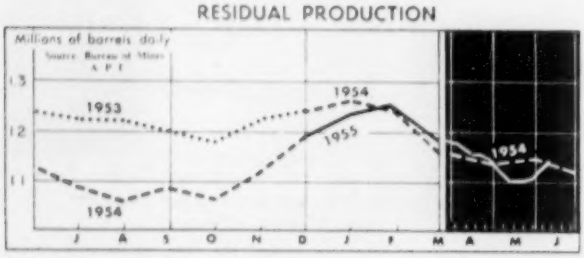
MIDDLE-DISTILLATE PRODUCTION



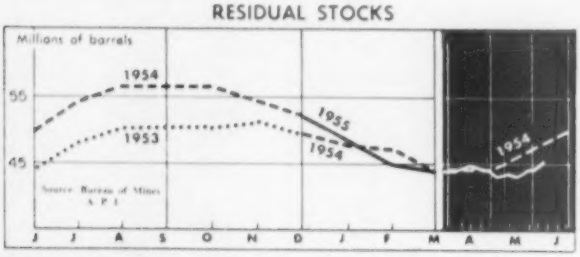
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



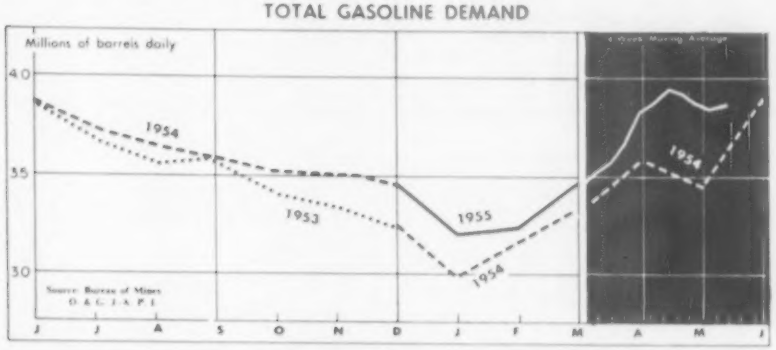
A.P.I. REFINERY REPORT, JUNE 10

(Thousands of barrels)

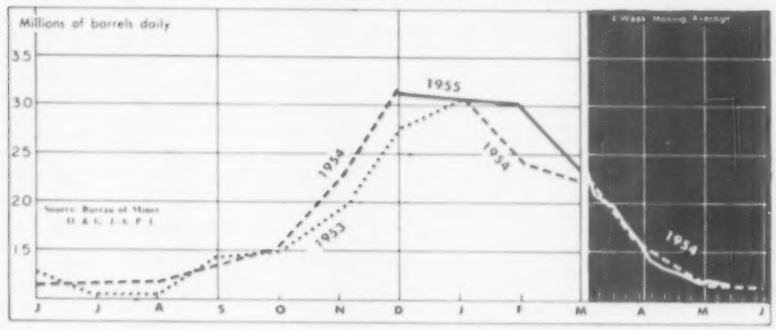
District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks† Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1954 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,081	436.7	26.7	253.6	207.2	37,031	11,270	28,905	9,128	1,031	429.3	31.4	230.1	187.5
Appalachian:														
District 1	82	31.3	2.4	17.6	3.7	4,547	476	1,785	320	108	47.2	3.5	23.9	8.5
District 2	101	52.0	2.6	13.0	9.3	2,382	366	670	289	93	52.8	3.5	10.2	10.7
Ind., Ill., Ky.	1,399	722.6	56.6	261.0	165.7	34,409	6,311	16,925	4,239	1,273	675.1	67.4	234.2	154.4
Okla., Kans., Mo.	713	420.4	27.3	159.9	37.7	15,742	1,566	9,913	866	615	350.6	19.7	132.4	43.8
Inland Texas	265	204.8	8.6	50.1	23.7	6,316	406	1,661	1,324	243	173.4	8.6	44.2	23.7
Texas Gulf Coast	1,825	881.7	72.1	421.1	235.3	23,032	3,336	10,464	4,433	1,630	779.9	103.5	357.5	220.2
La. Gulf Coast	658	343.6	7.4	229.0	55.6	10,362	1,838	4,870	1,448	565	268.1	51.3	143.0	46.4
N. La. and Ark.	88	32.7	6.7	20.6	5.4	3,552	866	1,644	70	89	36.0	7.4	19.7	6.5
Rocky Mountain:														
New Mexico	21	11.9	1.0	3.0	2.9	221	5	99	30	20	11.7	0.2	3.7	2.6
Other Rocky Mt.	276	129.0	5.6	62.9	42.4	7,330	225	2,129	875	256	126.6	3.8	56.1	36.6
California	1,013	445.4	8.6	187.6	347.7	21,309	367	9,349	22,172	1,024	428.6	5.6	143.9	382.1
June 10, 1955	7,522	3,712.1	225.6	1,679.3	1,136.6	166,233	27,032	88,414	45,194	6,947	3,379.3	305.9	1,398.9	1,123.0
June 3, 1955	7,565	3,567.6	308.4	1,691.1	1,127.7	168,985	26,344	84,345	44,359					
June 11, 1954	6,820	3,276.3	247.0	1,398.9	1,207.9	171,370	24,807	77,495	48,530					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

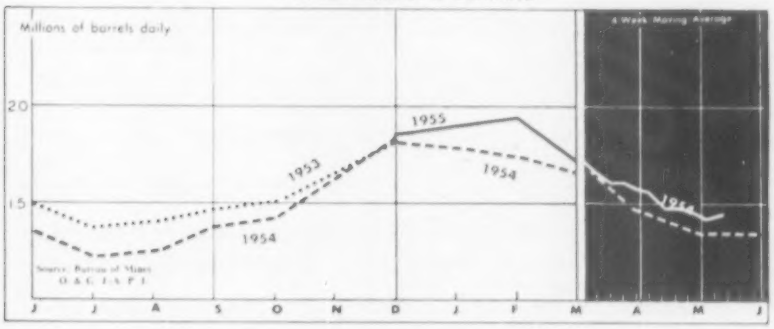
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of June 15, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.75-11.25	11.25-12	10.25-10.75
Premium gasoline	12-12.5	13-13.75	11.50-12
42-44 w.w. kerosine	9.25-9.625	10.05	8.5-8.75
No. 2 straw fuel oil	8.375-8.75	9.3	8.0-8.25
No. 6 residual	$1.75-1.80	$2.35-2.45	$2.00-2.05

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	4.5	4.0	4.25
Grade 18-55	5.4	4.9	5.15

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• Residual prices moved up 5 cents a barrel in the Mid-Continent with some indication that the new quotation may be the top. Inland residual stocks are up slightly. Light fuels have drifted lower on the Group 3 market. A large distributor in the North Central area announced a summer-fill discount for distillate heating oils. Price protection was offered to the end of September.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 6-10-55	3,578	3,867
March 1955	3,460	3,408
May 1954	3,377	3,463
June 1954	3,379	3,894
Middle distillate:		
Four weeks ended 6-10-55	1,892	1,199
March 1955	2,060	2,297
May 1954	1,674	1,167
June 1954	1,705	1,151
Residual fuel:		
Four weeks ended 6-10-55	1,143	1,464
March 1955	1,185	1,749
May 1954	1,148	1,342
June 1954	1,123	1,339

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Sour. Includes New Mexico Permian.

Effective dates: California, February 16, 1953; east of California, June 15, 1953; Pennsylvania Grade, January 21, 1955.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.50
Middle District	3.37
Southwest Pennsylvania	3.08
West Virginia	2.97
Buckeye Grade	2.91
Zanesville Grade	2.72
Illinois Basin	2.90

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Inspection made immediately.
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Amarillo, Texas

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231 South Lasalle Street,
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FOR SALE EQUIPMENT

FOR SALE: ENGINE—165 Hp. Climax Model R61, maximum continuous Hp. rating 126. Herndon Drilling Company, 421 Mayo Building, Tulsa. Phone 4-9700.

FOR SALE: 1—Beaird—Ingersoll-Rand packaged Compressor Plant, Type 6-JVG (165 H.P.) Heavy Duty, direct connected, 4-cycle, gas engine driven, single stage equipped with 3—4¼ x 9 compressor cylinders, three hand operated fixed volume pockets, two hand operated valve lifters, 20" O.D. 500# W.P. intake scrubber, air starting equipment and controls for automatic operation. Designed for intake pressure range 100#-250#, discharge pressure range 500#-600#. Delivery 3,480 MCF per day at 250# intake, 550# discharge. This plant has been in use less than 30 days and is located near Palestine, Texas. Box H-616, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY EQUIPMENT

BOILERS: 200 H.P. 200 lb. W.P. Water tube with fittings—$3000.00; Three 80 H.P.—H.R.T.—150 lb. $500.00 each; Oilfield Type 100 H.P. 150 lb.—$500.00.
TOWERS: Fractionater 48"x74', price $1500.00; Fractionater 48"x24', price $1000.00; Vacuum Tower 48"x24', price $750.00.
HEATERS: Two 5000 bbl. per day, 7,500,000 B.T.U. crude oil, price $1500.00 each.
TANKS: 1000 bbl. Agitator, price $1500.00. Accumulators of various sizes—$50.00 each.
STILL TUBES: 4" Sched. 80—1¼% cr. ½ M—Spec. A-335; WP-11—80 pcs. New. 20' long, price $381.23 CFT.

ROTHSCHILD OIL COMPANY
12354 Lakeland Road
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FOR SALE EQUIPMENT

CLEAVER-BROOKS Steam Generator Units; 2 (Only) 17,500 lbs./Hr. Each, 100 PSI. Automatic, Gas Fired. Excellent. Refinery Materials Company, Box 14306, Houston.

FOR SALE—1—1600 bbls. and 1—1000 bbls. red wood National 3' stave tanks at a bargain located near Wichita Falls, Texas. 1110 City Natl. Bldg. Ph. 2-7889, Wichita Falls, Texas.

FOR SALE: Water pressure plant and Oil Well Pumping Power Equipment, including Clark, Bessemer and Reid Gas Engines, some convertible to Oil. Worthington, Clark and National Transit pressure pumps. National and Reid Bandwheel Powers, etc. For complete information, write QUAKER STATE OIL REFINING CORP., Box 337, Bradford, Penna.

WILSON SUPER—Cleanest small rotary in Oklahoma. New 1953. Stands doubles. New drawworks engine. Nearly new 10" Gaso mud pump. 3000' good 3½" drill pipe. Complete every way. Drills to 3700 feet easily. Bargain $40,000.00. Box H-829, The Oil and Gas Journal, Tulsa, Oklahoma.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

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Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

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Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.
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Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ⅓ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

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Phone 3-3276

USED EQUIPMENT

#527—Franks Model 44-TM, Single Drum, Truck Mounted Servicing Unit, 8x10x50' Single Pole Mast, Mounted on FWD Truck.
#536—Franks Model E.T. Single Drum Servicing Unit, 8x10x62' Single Pole Mast, Mounted on 1941 8S-F International Truck.
#526—Franks Super East Texas Double Clutch, Single Drum, Mounted upon KS-11 International Truck. No Mast.
#541—Franks Model ET Single Drum with 8x10x62-ft. Mast, Mounted upon 1948 Model K8 International Truck.

#517—Type 3 O.C.S. Servicing Unit mounted on 1942 Mack Truck. Located Odessa, Texas.
#525—50/60 Idece Skid Servicing Unit. Double Pole Mast. Mounted on International Tandem Truck.
#533—Cardwell KL Double Drum Spudder with 60 ft. derrick.

Write, Wire or Call

FRANKS MFG. CORPORATION
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BOX 3218, WHITTIER STATION
TULSA, OKLAHOMA

FOR SALE EQUIPMENT

FOR SALE—Horizontal Duplex Steam Pumps—10x8½x12—353 GPM—bronze fitted—max. discharge pressure 100 lbs.—6" suction—5" discharge—mfg. by American Marsh Co. Quantity available—NEW—Boston Metals Co. 313 E. Baltimore St., Baltimore 2, Md., Curtis 7-5050.

FAILING MODEL 55, truck mounted complete with drill pipe, trucks and necessary tools, now drilling irrigation wells. Write or call E. J. Mickle, 203 S. Ellison, Guymon, Okla., pho. 520.

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H. C. SMITH, SECURITY AND REED ROLLER ROCK BITS
Sizes from 5⅞" to 9⅞", Soft, Medium and Hard formations. Includes some Jet Bits.
All materials guaranteed factory new, manufactured 1952. No leasing agreement required. Write for detailed list and prices.

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FOR SALE EQUIPMENT

FOR SALE OR TRADE: Nearly new 2500 to 3000 ft. spudder, with tools, sheer poles and diesel motor, located in Oklahoma. Want spudder 1000 ft. capacity or large core drill, Failing preferred. Box 400, Great Bend, Kansas.

FOR SALE—At Oil Hill, Kansas, 4—Cooper Type 80 Twin Engine Compressor Units, with 8½"x20" Class A and 15½"x20" Class C Compressor Cylinders. Also 1—Type 80 Single DO. with 6½" and 10½" x 20" Tandem Cylinders. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

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FOR SALE: 1—Worthington Type HB Packaged Compressor Unit, single stage, 7" x 13" H-844 motor. Belt driven, equipped with 250# WP intake scrubber, Wahlberg-McCreary gas starting equipment and automatic controls. Delivery 1,600 MCFD at 100# intake, 350# discharge. Plant used 1 year. Box H-865, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE

1 Caterpillar generator, A.C., 15 K.W.
1 Century generator, D.C., 10 K.W.
1 General Electric generator, D.C., 10 K.W.
1 Westinghouse, D.C., 10 K.W., generator.
1 Kohler electric plant, D.C., 1½ K.W., 4 cylinder.
1 Kohler electric plant, D.C., 5 K.W., 4 cylinder.
1 Kohler electric plant, 5 K.W., Waukesha motor, F.C.-140.

All in excellent condition, may be seen at Makin Yard, Hobbs, New Mexico, or call 3-4062 or 3-3141.

MAKIN DRILLING COMPANY
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FOR SALE EQUIPMENT

FOR SALE—Wichita M Spudder with all tools. Will drill 2000 ft. Practically new motor. Burns Oil Company, Box 1098, Shawnee, Okla.

FOR SALE: Mayhew 1000 $5,000.00, Sullivan 200-A, Failing 750 $5,250.00, Sullivan 37 $4,750.00. Fred Butler, Box 481, Pueblo, Colo.

CORE DRILLS, SPUDDERS, ROTARIES: New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOR SALE: 1—National 2½" x 13' 125# WP Low Pressure Vertical Separator and 1—Petco 1000# WP Porous Plastic Horizontal Separator, each complete with controls. Location Joaquin, Texas. Box H-866, The Oil and Gas Journal, Tulsa, Oklahoma.

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Gardner-Denver Pumps and Compressor

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4½" O.D.—188 wall—approx. 8½ lbs. D.R. lengths—approx. 10,000 ft.
6⅝" O.D.—188 in. wall and .219 in. wall—approx. 13 lbs. and 15 lbs. D.R. Lengths—approx. 20,000 ft.
10¾" O.D.—203 wall 22.88 pound double random lengths—approx. 20,000 feet.
26" O.D.—188 wall 40' lengths—approx. 1,000 feet.
30" O.D.—344 wall 40' lengths—approx. 600 feet.

RECONDITIONED BLACK PIPE

8⅝" O.D.—322 wall 28.55 pound 16' to 20' Random Lengths—Approx. 8,500 feet.
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5—600 HP IR Type KVG Gas Engine Driven 2 Stage Compressors (1942).

1—660 HP IR Type KVG Gas Engine Driven 2 Stage Compressor (1952).

550,000 New Spare Parts for Above.

2—IR Starting Air Compressors, Model 25c, Type 40, 265#, 67.6 cfm.

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1—6' x 58' x ½" Shell Chrome-lined, 21 Trays, New 1951.
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2—1250 Barrel Steel Welded Tanks.
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7—Admiralty Tube, 500 - 1800 sq. ft.
2—Steel Tube, 800 sq. ft.

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8—715 sq. ft., 850 psig, 550° F., S.S.
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10,000' of 8", 6", 4" and 2" steel pipe.
500 Ton of structural steel, steel plate, angles and channels.
500 steel gate and globe valves.

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Murray Hill 7-5280

TULSA OFFICE
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Tulsa 3, Okla.
Phone 3-4890

FOR SALE EQUIPMENT

IDECO H30-S HYDRAIR, Single Drum Drawworks, air clutches, plain cathead. Excellent condition. $5,600. Write P. O. Box 2903, Beaumont, Texas.

FOR SALE: A Clean 1500' FAILING Model 44 Rotary Drill and Core Rig mounted on 4 wheel drive truck, complete with Dog House, Light Plant, and tools ready to work. Located in Eastern Illinois. Contact R. A. Landrey, Washington, Indiana. Phone 2395 W.

FOR SALE: 1—Mud Pump, 4½" x 10", Worthington Type KLS-1, with 36", 6 groove V-Belt Pulley. Less engine on engine skid. With new liners, rods and pistons. $1,750.00. 1—Rotary 27½" Oilwell, oil bath model 275. With 4" Kelley Bushings. $2,250.00. 2—V-Belt Sheaves, 56" diameter. 7 Groove "D". New price approx. $390.00. Sell $200.00 each. 1—Hydraulic Casing Pulling Rig, Jacks & Pump. $1,000.00. Bellaire Pipe & Supply Co., Inc. 8020 Lyons, Houston, Texas. ORchard 4-2763.

FOR SALE—Workover rig, with Wilson Giant Drawworks, 7¼x12 Gardner-Denver Pump, NKU Waukesha engines, 87' L. C. Moore mast, substructure, pipe racks, walkways, blowout preventers, light plants, rotary, block, hook, swivel water pumps, coring reel, bunk & tool houses, air tubing tongs, drill pipe tongs, bug blower, Kelly, small equipment and tools. Rig is complete and in excellent condition. Reasonable price. Detailed inventory available. Chet Whaley Well Servicing Co., Inc. 6006 Milart Street, Houston 21, Texas. Telephone: OLive 4-3261.

EQUIPMENT WANTED

WANTED good 7¼x14 slush pump. Give location and price. Box H-851, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED core drill in good condition. 600 or 1,000 Mayhew preferred. Give price, location, and make, size and age of truck. Box H-848, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED good used triple Lee C. Moore derrick. Give location, condition and price. Box H-849, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED 4000 to 5000 ft. power rig in good condition. Give location, description and price. Box H-850, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: One—Cooper-Bessemer GMX-4 Compressor, with high pressure cylinders. Box H-841, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: 8000 ft. 8 in. and 4,000 ft. 14 in. line pipe. New preferred. Will consider other sizes. Contact P. A., Northwestern Refining Co., St. Paul Park, Minn.

HELP WANTED

ATTRACTIVE OPENING for experienced natural gasoline plant operator at new plant located in S.E. New Mexico. Contact General Superintendent, Valley Gas Corporation, Carper Bldg., Artesia, New Mexico.

HELP WANTED

EXCELLENT OPPORTUNITY in New York Office for capable secretary, preferably with oil experience. Salary as deserved. Write, giving full details. Russell Maguire, 500 Fifth Avenue, New York 36, N. Y.

WANTED: Graduate electrical, civil or mechanical engineer for office and field work by major oil company in Middle West. Please state age, experience and educational qualifications. Box H-837, The Oil and Gas Journal, Tulsa, Oklahoma.

IMMEDIATE OPENING for graduate engineer desiring sales work. Home office location, Tulsa, Oklahoma. Give complete resume of experience, references, and salary expected in first reply. Box H-803, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

Manufacturers' Representative for South West Texas, Houston Gulf Coast, and So. Louisiana to sell production specialty equipment through Supply Stores. Reply kept confidential.

DROVIL COMPANY
P. O. BOX 58183
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Chemical Engineer

Unusual Opportunity

Unusual opening with moderate size, well-established engineering firm for young chemical engineer preferably with major company or equivalent experience. Good educational background and four or more years experience with modern refinery processing and design and economic studies. Acquaintance with catalytic reforming and cracking desirable.

An ambitious and resourceful engineer will find this an outstanding opportunity for personal advancement in assuming responsibility for many diverse projects in the oil and chemical industries. Very desirable location. A moderate amount of traveling is involved. Salary commensurate with ability.

BOX H-811,

The Oil and Gas Journal,
Tulsa, Oklahoma

"Chemical Process Design Engineer"

Midwest engineering and construction firm desires engineer to process design plants relating to petroleum refining, chemicals, natural gas, and natural gasoline.

Experience 5 years or more in one or more of the above fields. Reply giving resume of experience, education, reference, and salary requirements. Address

Box H-855,
THE OIL AND GAS JOURNAL,
Tulsa, Oklahoma

HELP WANTED

SUBSTANTIAL independent operating company would like to permanently employ an exploration geologist. Must be experienced, qualified, and have the ability to head an exploration program, operating in Oklahoma and Kansas. Send detailed personal history, work experience & salary expected. Box H-847, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE AND CONSTRUCTION SUPERVISOR

for expanding independent refinery in Upper Midwest. 5 or more years refinery or process plant experience required. Challenging opportunity for qualified man. Write giving full particulars.

Box H-831, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEERS

Openings for Chemical Engineering Graduates with minimum 3 years experience in Process Plant Design. Work involves project engineering, equipment application and selection, translation of process data into new plant design. Applicant should be well grounded in thermodynamics, unit operations, and equipment specifications. The work is interesting, salary and opportunities are attractive; location in Texas. Mail resume to

Box H-820,
The Oil and Gas Journal,
Tulsa, Oklahoma.

CORROSION ENGINEERS

Prominent engineering and construction firm with headquarters in New York has permanent positions open for graduate Electrical Engineers or equivalent.

Attractive starting salary with opportunity for advancement. Minimum 4 years experience in field testing and design of corrosion mitigating systems required. Must be willing to travel.

Submit resume of experience, education and personal data to:

Box H-846,
The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

LARGE NATURAL GAS company needs Process-Project Engineer with 3 to 5 years experience for design of gasoline plant, compressor station and gasoline treating facilities for a gas transmission company located in Colorado. Furnish complete background, data and salary expected. Box H-852, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS, Executives, Technical Men. Salaried positions—$6,000 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 434 Frick Bldg., Pittsburgh 19, Pa.

Chief Geologist

For independent integrated oil company. Must have 10 years experience. Houston location. Send detailed history, giving salary expected.

Box H-853, The Oil and Gas Journal, Tulsa, Oklahoma.

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We can offer chemical engineer, or equivalent, a unique and "lifetime" opportunity. What we have in mind is not a salesman necessarily, though sales experience would be helpful; but a man who can represent us, and sell our "specialty items" to refinery laboratories and laboratories engaged in petroleum testing.

Position is ground floor opportunity in new division offering personal and financial success. Initial training will be in Chicago. Future assignments will be in Mid-west or East-coast territories. Naturally, your preference will be considered.

Your application will be considerately studied. All replies will be confidential. Interviews will be arranged for mutual convenience.

BOX H-867,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

HELP WANTED

GEOLOGIST of outstanding ability, under 35, with at least 3 years' experience in northern Louisiana, gulf coast and west Texas areas. Exploration and development experience essential for Dallas office of established independent oil concern. P. O. Box 2775, Dallas, Texas.

DISTRICT LANDMAN Position Open. Strong, independent company has position for District Landman at Midland, Texas. Applicant should supply complete resume of experience and qualifications which will be treated confidentially. Box H-868, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

Petroleum Engineers

Graduate Petroleum Engineers with minimum 5 years' diversified production experience wanted by MAJOR OIL CO. with operations in Mid-Continent area from Gulf Coast to Canada. Salary commensurate with training and experience.

BOX H-856,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

DIVISION GEOLOGIST

Independent oil company has opening in Tulsa office for Division Geologist to handle operations in Oklahoma and Kansas. Must be experienced in this area and be qualified to handle intensive exploration program. Excellent salary and opportunity. Age limit 35. Give complete resume of past experience, education and personal information. Applications confidential.

BOX H-862,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

OIL INDUSTRY Employment Service. Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Oklahoma. Specializing in Engineers with oil-industry experience.

JUNIOR ENGINEER to operate experimental profiling device for water flood injection wells. Unequaled opportunity to learn newest secondary recovery techniques and to participate in experimental work. Location Nowata, Oklahoma. Approximately one-half time traveling. Prefer graduate engineer with working knowledge of electrical circuits and some oil field experience. Write Sinclair Research Laboratories, Inc., P. O. Box 3006, Whittier Station, Tulsa, Oklahoma.

FOREST MANAGEMENT

An independent, experienced land management organization. Our forest management division, rendering professional forestry services in La. and E. Texas, specializes in developing sustained timber yield on oil industry fee lands.

FARMCRAFT ASSOCIATES, INC.
Alexandria, Louisiana.

DESIGN ENGINEERS

Well established, progressive company expanding its Houston, Texas manufacturing facilities requires additional design engineers. Experience in design and development of oil well drilling tools and equipment would be favored. This is not just another job. If you have ability and can think, opportunity exists. Send complete information and salary requirements. Confidential.

BOX H-836,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

Mechanical Engineers

A medium sized leading manufacturer of oil field equipment and gray iron castings now needs additional engineers for product development and design work. Experience in similar or related work would be favored. All replies confidential. Write stating full qualifications and salary requirements to

BOX H-874,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

ESTIMATOR

Large midwest engineering and construction firm has opening for man with prior estimating experience in the Gas, Oil and Petroleum fields.

This man must be able to assume complete responsibility for take-off and setting up an estimate. Ability to do preliminary layout work desirable.

In reply, furnish a detailed resume of your education, experience, references and salary requirements.

BOX H-872,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

ELECTRICAL INSPECTOR

Electrical engineering degree required, plus minimum 4 years experience shop inspection, or shop supervision & testing, of oil refinery electrical equipment such as switch gears, transformers, motor starter protection & minimum 4 years field supervision on installation of such equipment. Electrical design & specification writing preferred.

Please apply only if age 30 or above and providing you possess the required qualifications & experience. Interviews arranged at our expense on basis of confidential complete chronological resume, including education and employment (names & addresses of employers, dates employed, positions held & your specific duties & scope of responsibility, salaries received, location & type of jobs, etc.). Airmail data to

PERSONNEL DEPARTMENT

HYDROCARBON RESEARCH, INC.

115 Broadway New York 6, N. Y.

HELP WANTED

NEED PRODUCTION MAN capable supervising 300 barrels production. Must be able handle completion work, all types and depths. Want non-drinker and Christian. Advise past record, age, salary expected, education, availability. Box H-873, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER

Excellent opportunity for young Chemical Engineer in natural gas division of a large progressive independent oil company. Prefer recent graduate or individual with no more than one or two years experience. To be located in Oklahoma. Please submit college transcript and recent photograph.

GEOLOGIST

Recent Geological or Geological Engineering graduates wanted for employment as seismo computer. Will be working with field seismic parties. Excellent opportunity for advancement. Please submit college transcript and recent photograph.

Box H-864, The Oil and Gas Journal, Tulsa, Oklahoma.

Engineer - Designers

For plant project work in a new petroleum chemical plant in Memphis, Tenn. To handle estimating, design, and field supervision of plant alterating and additions. Required BS degree and 3 to 8 years of project experience in refinery or petro chemical field. Send complete resume, including personal duty, education, work and salary experience to

INDUSTRIAL RELATIONS DEPT.,

GRACE CHEMICAL CO.,

P. O. BOX 4906,

MEMPHIS, TENN.

MANUFACTURERS REPRESENTATIVE Reciprocating Pumps

Duties: Cover water flood, gasoline plants and general industrial sales, Oklahoma, Kansas, Arkansas.

Qualifications: Small active organization. Familiar oilfield operations and services.

Give full resume, sales coverage, personnel and present line. Replies will be held confidential.

BOX H-838,

THE OIL AND GAS JOURNAL,

TULSA, OKLAHOMA.

AREA ENGINEERS

Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE

NEW YORK 22, NEW YORK

HELP WANTED

GRADUATE Chemists with or without experience for positions in Research and Development department, located in Tulsa. State qualifications and salary expected. Write Personnel Department, P. O. Box 381, Tulsa, Oklahoma.

Design Engineers

PERMANENT Opportunities with an engineering firm having 50 years of successful operation doing business all over the world. Openings at our main offices in Cleveland, Ohio, for ENGINEERS experienced in:

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Applicable to OIL REFINERY & PETRO-CHEMICAL Plant design.
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ARTHUR G. McKEE & CO.
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CLEVELAND 1, O.

PETROLEUM ENGINEER

We have an opening for a Petroleum Engineer in the Engineering Department of a company manufacturing a new type oil well pump. Will supervise installation of pumps on West coast. Real opportunity for man with proper qualifications to join young organization planning expansion program. Short product orientation period will precede assignment.

Degree and five years minimum experience required. Salary open. Write sending reply to:

Bob Hill, Jr.

401 E. Wayne Street

Fort Wayne, Indiana

Phone—Eastbrook—5908

WANTED

WANTED

WATERFLOOD PROPERTIES

Successfully installed and operating.

Would also consider pilot flood stage operations.

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Oil & Gas Division

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HELP WANTED

WATER-FLOOD ENGINEER—by independent oil-producing company. Should have field experience in Mid-Continent area water-flood development and operation. Reply should state qualifications and experience in detail. All applications confidential. Box H-673, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER with 6-8 years experience in process control, process design and economics to be in charge of Engineering Department in small Midwest Refinery. Reply should include resume of experience, education, references and salary expected. Box H-861, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM GEOLOGIST, desires position with independent in Mid-Continent area. Four years well sitting experience, West Texas, New Mexico and Rocky Mtn. area. Stratigraphic studies, acreage evaluation experience, recoverable reserve studies, subsurface mapping, electrical log interpretation. Box H-839, The Oil and Gas Journal, Tulsa, Oklahoma.

CORROSION and communications engineer. Ten years experience pipeline business. Desires employment. Box H-835, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST, 30, married, 6 years experience Rocky Mountain, (5 in seismic and gravity, 1 subsurface logs.) Desires position with active independent or major. Box H-845, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, 35, graduate, 9 years pipeline experience including pipeline engineering, economics, 4½ years products system operations and supervision. Desires responsible operations-management position with future. Box H-869, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN, eight years experience in title work, leasing, farmouts, administration with major company desires position with small company or independent. Box H-875, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTORNEY, 36, Notre Dame, A.B., LL.B., Wyoming and American Bar Associations. Married. Veteran. Solid general practice experience. Desires oil industry opportunity. Box H-870, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEM. ENGR.—41—15 yrs. wide experience all phases refining thru management level. Box H-871, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 29, single; B.S. Wisconsin. 6 yrs. sales-management exp. Desires position utilizing sales & geology. Martin Reiter, 55 Lenox Rd., Bklyn., N. Y.

WANTED

WANT TO BUY settled oil production by independent operator direct from the producer. No deals too small or too large. P. O. Box 77, Lafayette, La. Dudley J. LeBlanc

ROYALTIES

PIPELINES ANNOUNCED: Projected pipelines indicate increasing action in central Williston Basin, where we specialize in royalties in major company blocks. For informative material, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Mont.

JACK EAGLE, Oil Properties, 706 City Nat'l. Bldg., Oklahoma City, Oklahoma, Telephone REgent 6-7027.

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

OIL PRODUCTION ROYALTIES

Interested in buying oil production and producing royalties in good producing areas. Minimum monthly income on producing properties $4000, on royalties $750.

CONTACT BOX 2775, DALLAS, TEXAS

LEASE AND DRILLING BLOCKS

160 OIL LEASE near shallow Gas wells Carbon Co., Utah. Owner R. O. Barnsley, 950 Lincoln Ave. Palo Alto, Calif.

SEMI PROVEN Land Available at low prices in California. C. W. Farmer, Turlock, Cal. A Good Play Now On.

CASH FOR LEASE BLOCKS, anywhere. Tom Lee, Box 23, Redondo Beach, Calif.

WRITE TO Box 353, Spenard, Alaska, for information on available Government oil and gas leases in Alaska.

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Investments.

FOR SALE: Working interests in twelve producing oil wells in Russell and Ellis Counties, Kansas. W. G. Hills, Mankato, Kansas.

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Inquiries Invited

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URANIUM IN FLORIDA?

A $20,000,000 plant has been built at Bartow, Florida to recover uranium from phosphate fields. I have 640 acres for sale which an Airborne Radio Active Survey shows an area having 330 counts per second. (See Geophysical Investigation Map GP 122, published by the Department of Interior, United States Geological Survey). I will sell the 640 acre tract for $200.00 per acre and retain 1/8 royalty. Asher Peter, Realtor, 11 South Court Street, Orlando, Florida.

FOR SALE MAPS

BASE STRUCTURAL MAPS on linen, 1 in. to a mile covering portions of Oklahoma, Kansas, Colorado, Texas, up to date as of March 15, 1955. Oklahoma maps cover area generally from Twp. 9 South to 29 North and from Range 14 East to 26 West. Kansas maps are of area generally from Twp. 1 South to 35 South and from Range 1 West to 42 West. Rinehart well-completion cards covering Oklahoma wells dating from November 1949 to March 15, 1955. Instruments and furniture including 54 tube map case, drafting table, binocular microscope, pocket transit, hand level, filing cabinets, card cabinents, and 250 Schlumberger logs. Also current library of geological reference books and documents. These materials being disposed of to settle the estate of the late James K. Murphy, widely known Tulsa geologist. Communicate: H. L. Dyer, 305 Tri-State Insurance Bldg., Tulsa, Phone 4-0141.

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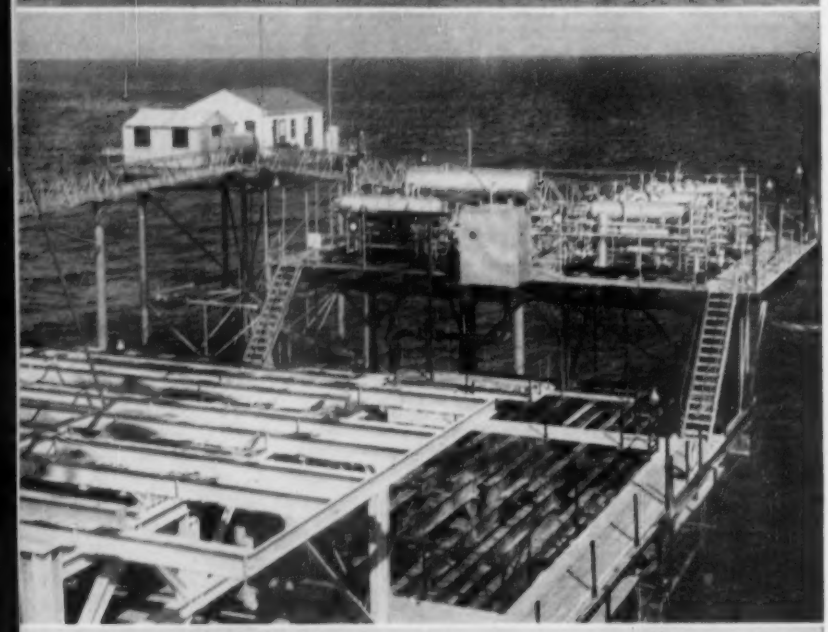
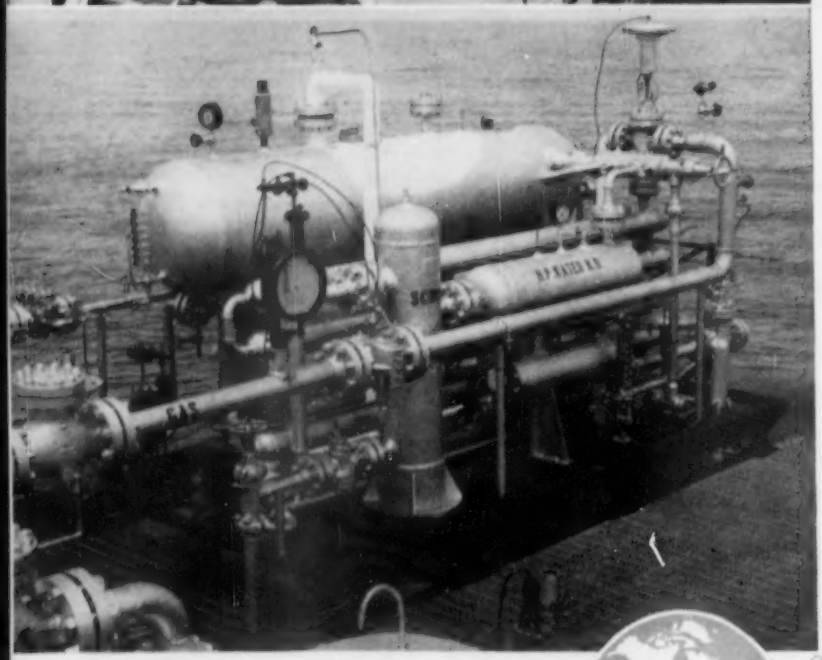
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries Incorporated 18

"Bills! Bills! Bills! Whatta' we gonna' do—put the bite on the oil industry for another couple of hundred million?"





OCEAN GOING LTX*

Eight miles off the coast of Vermillion Parish, Louisiana, in 40 feet of Gulf water, stands the first "ocean going" gas gathering line. Four directionally drilled gas-condensate wells are produced. Liquid is separated AT THE WELL.

The following standards for the separation equipment were set by the producing company:

1. Take shutin pressure of 3000 p.s.i. and step down to 1200 p.s.i. for pipe line.
2. Processed gas could contain no more than 14 lbs. water per MM cu. ft. with 7 lbs. preferred.
3. Separate maximum amount of distillate and free water.
4. Individual units for each well with minimum capacity of 10 MM cu. ft./day.
5. Added safety equipment to automatically shut in wells in event of disturbance.
6. Units had to be compact and complete with a mud and sand trap along with gas and distillate meter runs.

National equipment exceeded these specifications. NATIONAL LTX UNITS WERE CHOSEN.

First gas began to flow in early 1951 WITH A REMARKABLY LOW WATER CONTENT OF 4 LBS. PER MM CU. FT. OF GAS.

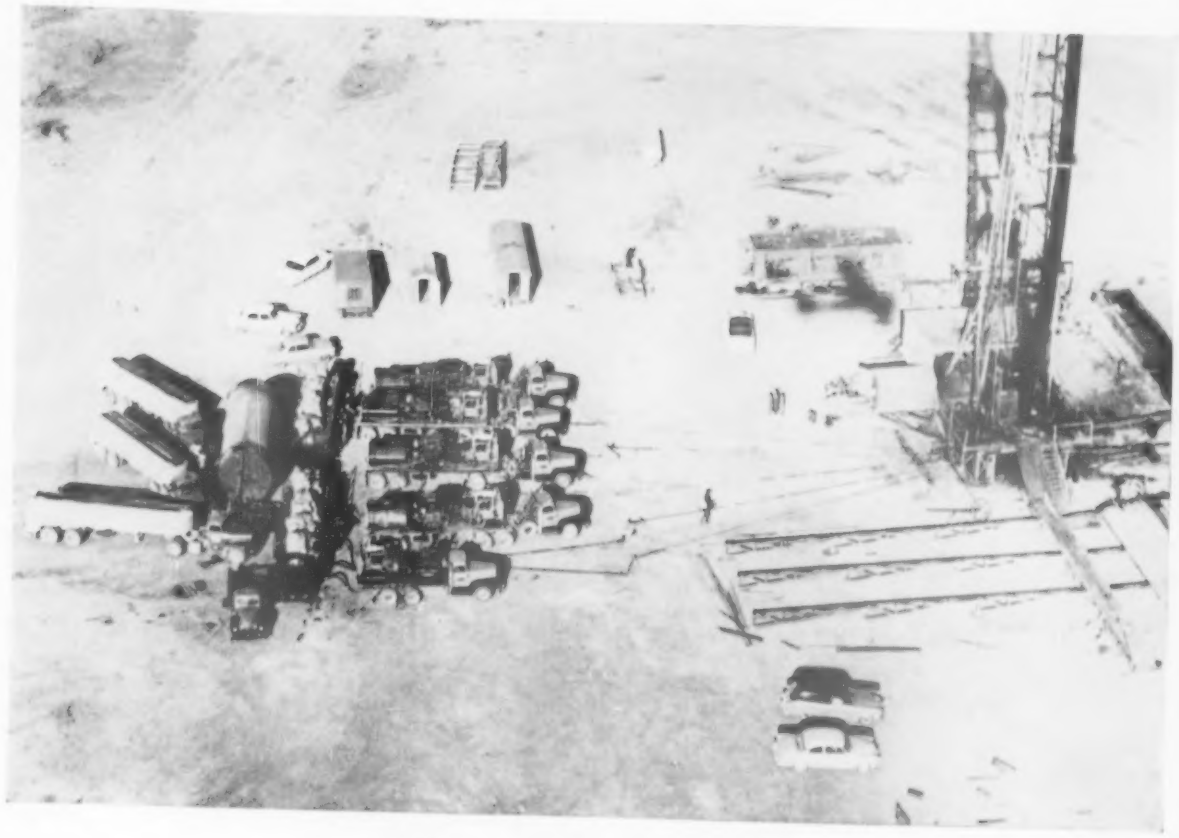
May we help you in solving your distillate extraction problems? Write for a paper covering full description of this installation.

*TM Reg. U.S. Pat. Off.

It's National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA



HIGH-INJECTION-RATE

SANDFRAC

DOWELL treatment resulted in over 12,000 extra barrels of oil in 6 months

Large-volume, high-injection-rate Sandfrac* treatments are building an encouraging record of successes. This new high-injection technique is achieving increased penetration which has resulted in improved recoveries over long periods.

In one such case a well with an initial potential of 332 BOPD, flowing, had fallen off after nine months, so that it was pumping only 8 BOPD. At this point a high-injection Sandfrac treatment was performed by Dowell—21,000 gallons of oil and 31,000 pounds of sand were pumped into the well at an average injection rate of 45.4 BOPM. Immediately following this, the well tested 315 BOPD. After six months the well still potentialed 96 BOPD. The estimated cumulative production during the 6 months period was 13,159 barrels.

Dowell has designed special mixing units and diesel pumping equipment to handle high-injection Sandfrac treatments. This is just one example of the way Dowell's versatile services are engineered to meet the needs of the oil industry.

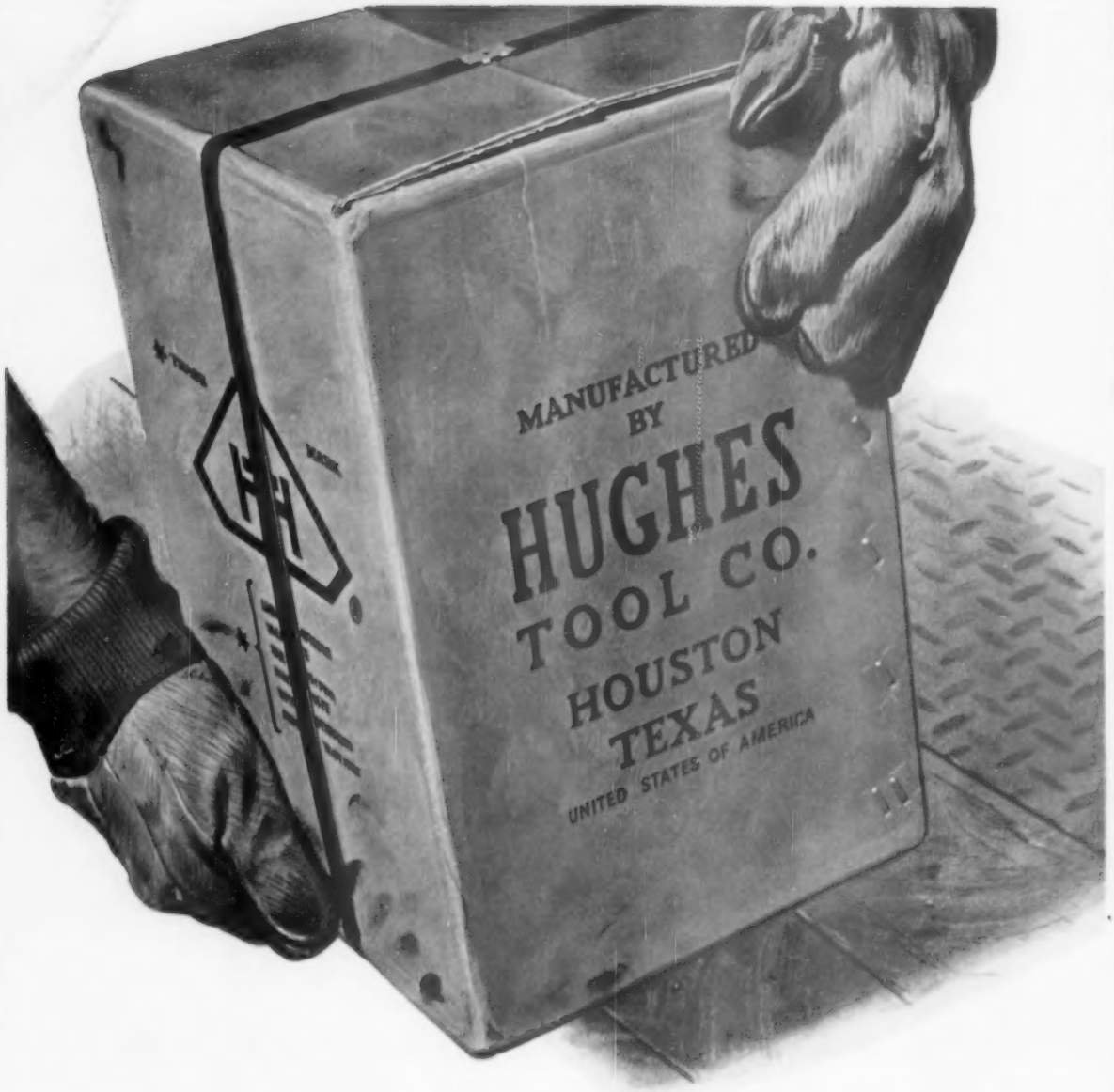
For more information about Dowell services for oil, gas and water wells, call the nearest Dowell office or write DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. F-11.

**Sandfrac is a registered service mark of Dowell Incorporated.*

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY



The "extra bit" in a Hughes bit box

Into every Hughes bit box is packed...

- the industry's greatest worldwide rock bit experience... gained in drilling over a billion feet of hole;
- 45 years of specialized research devoted to improving rock bit performance;
- consistent quality made possible by the industry's most advanced rock bit manufacturing facilities.

This combination of experience, research and manufacturing skill, plus integrity puts the "extra bit" into every Hughes bit box.